MANAGING UNEXPECTED DISRUPTIONS:

THE RESILIENCE OF SHIPPING COMPANIES

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Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

AUSTRALIAN MARITIME COLLEGE

UNIVERSITY OF TASMANIA

September 2018

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ABSTRACT

Modern shipping companies operate in a complex, unpredictable and dynamic environment shaped by globalisation and technical advances. Shipping companies are increasingly interlinked with economic, social and natural systems whose volatility creates unprecedented threats of disruptions that are characterised by uncertainty and complexity. A growing number of scholars recommend that resilience to unforeseen and unpredictable disruptions is necessary for organisations to survive and grow in the challenging 21st century environment. However, a literature review reveals that in the past there has been limited in-depth empirical investigation of the resilience of shipping companies, especially with respect to how shipping companies actually develop resilience capabilities.

The purpose of this thesis is to explore how shipping companies can prepare themselves to cope successfully with unforeseen and unpredictable disruptions. Thus, the primary research question for this thesis is: *How can shipping companies develop organisational resilience capabilities?* This is addressed by investigating (1) the organisational capabilities utilised by shipping companies to manage actual disruptions and threats; (2) the activities occurring in shipping companies that contribute to the development of organisational resilience capabilities; and (3) conceptualisation of resilience by decision-makers who plan, control and facilitate organisational activities.

The sample for this thesis was drawn from shipping companies operating in Australia. The companies surveyed were engaged in operating ships across a diverse range of sectors – liner shipping, dry bulk, tanker, passenger, general cargo, RO-RO and support services. Primary data was obtained through 30 telephone interviews of senior managers

representing 32 shipping companies. The telephone interview questionnaire consisted of a mix of qualitative and quantitative items, enabling a pragmatic investigation based on the conceptual framework developed for this study. The conceptual framework was based upon four key organisational capabilities identified in the literature review as contributing to resilience – awareness, learning, innovativeness and robustness.

Analysis of data confirms that shipping companies operate in an environment where multifaceted threats emerge unexpectedly from diverse causes such as market volatility, industrial accidents, natural events, supply interruptions, institutional rules and operational contingencies. The disruptions experienced by shipping companies varied in scale in terms of their impact on the companies. It was found that the variance in impact was influenced by the extent of modularity and diversity in the company. Modularity influenced the localisation of impact and diversity enabled flexibility of response. However, this study also found that shipping companies can develop resilience capabilities regardless of size, type and area of operation.

This study found that traditional management techniques of planning and control for risk management are effective in reducing the likelihood of disruptions and improving the preparedness of shipping companies to manage crises. The challenge of coping with unforeseen situations remains however, as a result of trade-offs made by shipping companies in balancing risk and commercial opportunities as well as due to circumstances beyond their control. This study found that the concept of resilience is still under development among senior managers of shipping companies. Nevertheless, senior managers facilitate activities to develop resilience capabilities in their organisations. By addressing resilience of shipping companies from a holistic perspective of both avoiding and withstanding disruptions, this study contributes to the emerging body of empirical studies on organisational resilience. In addition, this study proposes a definition of

resilience and provides recommendations that may be useful in guiding managerial thought and practice towards both short term performance and long term sustainability of shipping companies. From a methodological perspective, the study highlights strategies that were effective, and those that were less effective, in addressing the challenge of interviewing elites.

ACKNOWLEDGEMENTS

This has been a long, often stormy, but ultimately a rewarding voyage of discovery for me. The journey would not have possible without the support, guidance and understanding of Assoc Prof Stephen Cahoon. Stephen has been a wonderful and supportive guide, mentor, colleague and friend to me. I am inspired by Stephen's work ethic and commitment to the pursuit of knowledge. I am truly grateful to Stephen for standing by me when personal circumstances threatened to derail my journey.

Dr Shu-Lin Chen has guided me with her thoughtful advice whenever I needed it. Her calm presence and encouraging words have helped me overcome many rough patches on the way. I am grateful to Peggy for helping me achieve my aim.

I wish to thank my friends and colleagues at AMC who have supported me immensely. Dr Hilary Pateman provided me with words of wisdom that helped clear my often foggy thoughts. My line managers Prof Neil Bose and Prof Natalia Nikolova gave me the opportunity to channel my efforts towards the completion of this thesis during its final stages. Jackie and Heather at the MLM office held the fort for me on numerous occasions so I could concentrate on my research. I thank you all for your kindness.

Last but not least, I am forever grateful and indebted to my long-suffering family who have stood by me patiently even though I have been an absent partner, father, son and sibling for much of the period of this journey. Today as I find myself on the verge of joining the community of scholars, I thank you from the bottom of my heart for helping me realise my dream.

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GLOSSARY

AMSA	Australian Maritime Safety Authority
BCM	Business Continuity Management
CAS	Complex Adaptive System
CEO	Chief Executive Officer
HRO	High Reliability Organisation
HRT	High Reliability Theory
ILO	International Labour Organisation
IMO	International Maritime Organisation
ISM Code	International Safety Management Code
IT	Information Technology
MIAL	Maritime Industry Australia Limited
NAT	Normal Accident Theory
OSM	Other Senior Manager
PRQ	Primary Research Question
P-Value	Probability Value Within a Statistical Hypothesis Test
SAL	Shipping Australia Limited
SRQ1	Secondary Research Question 1
SRQ2	Secondary Research Question 2
SRQ3	Secondary Research Question 3
STS	Socio-Technical System
UN	United Nations
US	United States

CHAPTER 1: INTRODUCTION

1.1 Background to the research

Shipping is considered the backbone of international trade (Shi & Li 2017). UNCTAD (2012) estimates that around 80 percent of global trade by volume and 70 percent by value takes place via ships. Globally, in total there were 90,917 commercially operated ships of 100 tons or more in size with a combined deadweight tonnage of 1.8 billion tons as at 1 January 2016 (UNCTAD 2016). Ships are an essential component of global supply chains and thus play a key role in the economic prosperity and social well-being of people around the world. Ships transport goods, people, technology, knowledge, ideas and values to all corners of the world. Thousands of ubiquitous shipping companies operate seagoing ships to provide the types of transport services that the world desires. Today, as debate flourishes about the impact of international trade on society and the environment, shipping companies are positioned at the forefront of the solutions for sustainable development because the world relies upon efficient transportation of goods and services by sea.

Ships have plied their trade across the seas since ancient times. In some respects, the nature of shipping, particularly the risks inherent in a sea voyage, has remained largely unchanged in the preceding millennia such that even today a ship's voyage is sometimes referred to as a marine adventure (Malbon & Bishop 2006). As defined by the Australian *Marine Insurance Act 1909*, a marine adventure occurs because a ship is exposed to maritime perils that include 'perils of the seas, fire, war perils, pirates, rovers, thieves, captures, seizures, restraints, and detainments of princes and peoples, jettisons, [and] barratry'. There can be serious human and financial costs to shipping companies if their ships are involved in major accidents caused by storms, groundings, fires, collisions,

piracy and similar events. Therefore, a significant amount of shipping companies' efforts is directed towards operational safety and prevention of accidents.

Shipping accidents can cause disruptions to shipping companies' business, but in some cases the impact of such accidents often extends beyond the confines of the affected ships and companies. There is usually a strong community and government response when shipping accidents result in extensive damage to life, environment and property (Kristiansen 2005). For example, there was considerable public anger at the loss of life which resulted from the sinking of the *Herald of Free Enterprise* in 1987, *Scandinavian Star* in 1990 and *Estonia* in 1994 (Kristiansen 2005). The United States (US) and the European Union imposed new shipping regulations following the oil pollution caused by *Exxon Valdez* in 1989 and the sinking of *Prestige* in 2002 respectively (White 2007). The examples cited by White (2007) are illustrative of the increased oversight of shipping companies by regulatory bodies following major accidents.

Shipping companies operate their ships under prescriptive rules and regulations set by governments and their agencies. For example, the Australian Maritime Safety Authority (AMSA) issues *Marine Orders* that must be complied with by companies who either register or operate ships in Australia. Many national rules and regulations are based on international standards for the design, construction, equipment, operation and manning of ships. These international standards primarily arise from United Nations (UN) conventions (for example, the *United Nations Convention on the Law of the Sea*) and other international conventions held under the auspices of UN bodies such as the International Maritime Organisation (IMO) and the International Labour Organisation (ILO) (for example, the *International Convention for the Safety of Life at Sea* and the *Maritime Labour Convention*). Societal concern with shipping activities is not confined to shipping accidents and their potential for wide-spread destruction, but extends to the

impact that shipping operations have on the natural environment. Hence shipping companies face strict international, national and local requirements concerning the impact of their ships on the natural environment. Such requirements result in operational restrictions on a range of activities such as the discharge of oils and chemicals into the sea, emission of pollutants and greenhouse gases from ships' machinery, transportation of alien invasive species through ballast water used by ships, the types of paints that may be applied on ships' hulls, and the disposal of garbage generated on ships. Regulatory control even extends to some aspects of the management and operation of shipping companies via IMO's *International Safety Management (ISM) Code*. As per the *ISM Code*, shipping companies are required to implement a safety management system that establishes safeguards against all identifiable safety and pollution related risks.

International shipping standards are enforced through a regime of inspections, surveys and certification by the country where a ship is registered (the Flag State), supported by a system of control measures applied by the country of the port that the ship visits (the Port State) (Grewal 2008). Consequently, efforts related to compliance with rules, regulations, guidelines and codes constitute a significant portion of the management activities of shipping companies (see, for example, the technical and crew management tasks listed in the standard ship management agreement developed by the Baltic and International Maritime Council BIMCO 2009). The pervasiveness of regulatory control in shipping has led to the creation of a 'culture of compliance' in the shipping industry (Kristiansen 2005, p. 467). The world increasingly demands high reliability operations from organisations that operate in hazardous environments (Roberts & Bea 2002) and shipping companies are no exception. Non-compliance with regulations is a serious threat to shipping companies as it can result in ships and crews being detained and companies fined.

Shipping companies operate in a dynamic business environment. The demand for shipping services is derived from the demand for international trade (Mason & Nair 2013; Moreira 2013; Stopford 2009). Hence fluctuations in international trade have a direct impact on shipping services because shipping companies typically derive their inputs, and offer their services, on a global basis (Giannakopoulou, Thalassinos & Stamatopoulos 2016). Overall, the total volume of global seaborne trade has been increasing rapidly over the last decades (Caschili & Medda 2012; Sjöqvist & Sorocka 2011). Sjöqvist and Sorocka (2011) identify three reasons behind the growth in seaborne trade: liberalisation in international trade; more cost-efficient transportation due to enhancements in ship design and shipbuilding; and, discovery of new sources of raw materials. However, while the volume of seaborne trade has grown, the freight markets remain volatile undergoing cycles of booms, recessions and depressions (De Monie, Rodrigue & Notteboom 2011; Stopford 2009). There is extreme competitiveness in the shipping industry and individual companies' actions to remain ahead of their competitors often adds capacity to the market for which there is little demand. (Kou & Luo 2016; Lorange 2005). As Kou and Luo (2016, p. 389) explain:

> Shipping companies are competing in a global market where each has very little influence on the market freight rate…To outperform its peers and to be successful in the market, the company has to select the best time to invest…New [ship] orders can be driven by a high market demand, by a low newbuilding price, or by the expansion decision of competitors. This expansion behaviour is optimal from the perspective of each individual company, but can result in prolonged overcapacity in the market, which…reduces the profitability of every company in the market.

Shipping is a capital intensive industry and shipping companies require significant amounts of finance to fund their ships (Paun & Topan 2016). Since the global financial crisis of 2008, the risk exposure in shipping has affected companies' ability to finance new ship acquisitions from commercial banks, which has caused an increasing number of shipping companies to enter stock markets (Wang, Woo & Mileski 2014). The pressure

to create more value for shareholders is forcing managers of shipping companies to seek 'high levels of efficiency for survival, achieving more output with less input than competitors' (Wang, Woo & Mileski 2014, p. 652). The quest for achieving efficiencies through reduction in operating costs is leading to greater risks. Shipping companies are progressively operating larger and larger ships in order to achieve greater economies of scale. In 2017, there are container ships already in service that can carry more than 20,000 twenty-foot equivalent units (TEUs) of freight containers (Marine Insight 2017). Larger ships increase the magnitude of risk involved in transportation. An estimated five percent to 10 percent of all containers carried on ships contain dangerous goods, and accidents involving such goods can be costly (Mackay 2008). If a large container ship were to sink or be destroyed with all its cargo, the monetary loss could well exceed US $2.1 billion (Mackay 2008). Even when carrying non-dangerous cargo, ships such as large bulk carriers face the prospect of structural failure due to stresses created by high loading rates in terminals wishing to load cargo as quickly as possible in order to keep costs down (Harrison 2008). Modern large and sophisticated ships require competent crews to operate them. Crewing costs represent a significant portion of ship operating costs (Stopford 2009). Many shipping companies register their ships under flags of convenience and employ ships' crews from low cost countries; leading to industry concerns about the quality and abilities of some seafarers (Cahoon, Haugstetter & Bhaskar 2010).

While shipping accidents do have the potential to seriously disrupt the business of affected shipping companies, such accidents are not the only threat that modern shipping companies face to their survival and growth. Similar to other organisations, shipping companies operate in a complex, unpredictable and dynamic environment shaped by globalisation and technological advances (Giannakopoulou, Thalassinos & Stamatopoulos 2016; Goulielmos 2002; Moreira 2013). There is increasing volatility in

natural, economic and social systems which is leading to unprecedented new forms of challenges (Smith & Fischbacher 2009). The nature of change itself is becoming more turbulent, complex and uncertain (Smith & Fischbacher 2009). Thus, disruptive events, whether they are rapid onset low probability high consequence events such as financial meltdowns, sabotage, terrorism, and natural disasters, or those that occur at a relatively slower rate such as climate change and market changes, may cause unexpected and unpredictable consequences. Adding to the complexity, there is increasingly greater individual, organisational and community interconnectivity (Fiksel 2003) so that events occurring in one part of the world, for example earthquakes, have the potential to cause widespread disruption and chaos as their impact spreads through interconnected entities and supply chains (Sheffi & Rice 2005).

The standard human approach to sustaining what humans find valuable is to reduce risk and vulnerabilities, and to become more efficient in crisis response (Martin-Breen & Anderies 2011). However, conventional management techniques that rely on mitigating identifiable risks and planning for predictable situations may not be adequate to face 21st century challenges because change is no longer linear and predictable (Friedman 2005; Parsons 2010). As a consequence of globalisation and technological advances individuals, organisations, communities, institutions and the natural environment are interlinked in a complex manner which makes it intellectually difficult to foresee all possible interactions among entities (Leveson et al. 2009; McDaniel 2007). The challenge for managers therefore becomes one of preparing their organisation to cope with change that is unforeseen and unpredictable.

1.2 Purpose of the research

Several scholars have suggested that in this era of complexity and uncertainty, organisations should focus on building resilience capabilities in order to cope with unforeseen and unpredictable situations (see, for example, Akgun & Keskin 2014; Boin & van Eeten 2013; Braes & Brooks 2010; Burnard & Bhamra 2011; Duijnhoven & Neef 2014; Fiksel 2003; Kerr 2016; Klockner 2017; Kolay 2016; Lee, Vargo & Seville 2013; Lengnick-Hall, Beck & Lengnick-Hall 2011; Serrat 2013; Seville 2017; Tillement, Cholez & Reverdy 2009; Välikangas 2010). A topic search for organisational resilience on the Web of Science database conducted on 29 September 2017 revealed an increasing frequency of articles pertaining to organisational resilience published in the last 25 years. Thirteen articles were published between 1993 and 1997, 19 were published between 1998 and 2002, 78 were published between 2003 and 2007, 234 were published between 2008 and 2012, and 673 have been published since 2013. Hence, it appears that the notion of organisational resilience is increasingly finding interest among scholars.

As will be discussed in Chapter Two and Chapter Three, much of the literature concentrates upon developing resilience capabilities – the organisational characteristics and processes – that, presumably, enable an organisation to achieve the desired resilience outcomes if it were actually confronted by an unexpected disruption. The underlying assumption is that if an organisation possesses the appropriate capabilities that are observable during normal routine situations, it will utilise those capabilities to exhibit resilient behaviour in adversity. However, the concept of organisational resilience is relatively new in empirical terms (Kay & Goldspink 2012). Boin and van Eeten (2013) further point out that the literature is mostly normative and prescriptive, with little

empirical research that studies the relationship between organisational capabilities and the outcomes of resilience.

In the context of shipping, Notteboom and Lam (2014) note a growing intensity in uncertainty and risk due to a fast changing and unpredictable environment. Notteboom and Lam (2014, p. 611) comment that 'companies are trying to face uncertainty, risks, and increased market competition through a range of strategies and management tools'. However, few empirical studies have been undertaken regarding management of unforeseen and unexpected events by shipping companies. These studies have largely focussed on identifying and mitigating risks that may cause disruptions in specific contexts. For example, Lam and Bai's (2016) study of three liner shipping companies identifies risk factors and their mitigation if customer requirements in the maritime supply chain are not met. Similarly, Fischer et al.'s (2016) study of RO-RO shipping investigates disruptions in fleet deployment. Gurning and Cahoon's (2011) analysis of maritime disruptions and mitigation strategies is based upon the Australia-Indonesia wheat supply chain. Mason and Nair's (2013) study of three liner shipping companies investigates how shipping companies can restrict an oversupply of container capacity to mitigate the risk of supply/demand imbalance. However, risks must first be foreseen before they can be mitigated (Berle, Rice & Asbjornslett 2011). The shipping related literature does not provide clarity on how shipping companies can develop resilience capabilities for coping with situations that are unforeseen. Moreover, the extent to which findings from studies conducted in specific contexts or in relation to organisations outside of shipping can be generalised to shipping companies remains unclear. To address these gaps, the primary research question (PRQ) developed for this thesis is:

PRQ: How can shipping companies develop organisational resilience capabilities?

To answer PRQ, three secondary research questions are raised. First, it is difficult to understand an organisation's resilience without it being tested in, say, a situation of crisis brought about by an unexpected disruption (Lee, Vargo & Seville 2013). It is therefore necessary to investigate which organisational capabilities are being utilised by shipping companies to cope with actual disruptions and threats of disruptions. Hence the first secondary research question (SRQ1) seeks to determine:

> *SRQ1: Which organisational capabilities contribute to the resilience of shipping companies?*

Second, this study seeks to explore the range of activities occurring within companies that contribute to the development of resilience capabilities. As the unit of analysis is the shipping company, this study takes a holistic view of organisational activities by focussing on those activities that influence the resilience of the company as a whole. Activities that occur within companies are influenced by the actions of the decision-makers in individual companies – the senior managers. Hence the next secondary research question (SRQ2) seeks to investigate:

> *SRQ2: How do senior managers of shipping companies develop their organisation's resilience capabilities?*

Third, as discussed in Chapter Two, there are different interpretations of resilience in the literature (see, for example, the lists of definitions provided by Bhamra, Dani & Burnard 2011; Brand & Jax 2007; Manyana 2006). The different meanings attached to the notion of resilience presents the challenge of content validity in studying resilience capabilities. To overcome such a challenge, Babbie (2014, p. 151) advises researchers to refer to both the literature as well as the subjects of study 'as sources of agreement on the most useful

meanings and measurements of the concepts they study'. Accordingly, the third secondary research question (SRQ3) for this study is:

SRQ3: How is organisational resilience characterised by senior managers of shipping companies?

1.3 Contributions of the research

This study makes several potential contributions to theory and management practice. First, this study will add to the small body of empirical studies pertaining to organisational resilience. The study attempts to address Boin and Eaten's (2013, p. 430,443) observation that 'we do not really know what causes resilience or how it is achieved…recipes for resilience, however, are built on a rather weak empirical and theoretical basis'. This study will assist in greater understanding of the link between organisational activities and their outcomes which contribute to resilience.

Second, the study involves a holistic exploration of the activities that contribute to the development of organisational resilience capabilities of shipping companies. The study investigates activities that enable shipping companies to successfully cope with unexpected disruptions and threats that may arise from any unforeseen cause. Hence the study is not limited to any particular type of disruption or disruption caused to any particular business activity. The study develops a conceptual framework that is empirically tested. Findings from this study will therefore lead to the identification of practices that may be useful for managers from a diverse range of shipping companies operating in the liner, tramp, passenger or support services markets. Shipping companies with well-developed resilience capabilities may be better placed to survive and grow in a volatile environment than competitors with less developed resilience capabilities.

Third, this study will provide a definition of organisational resilience that may contribute towards further understanding of the construct of resilience among researchers and practitioners alike. As will be discussed in Chapter Two, the meaning of resilience is often contextualised by the type of outcome or performance achieved by an organisation under threat from disruptive change. Thus, for example, resilience may mean that an organisation either absorbs unexpected change with little adverse effect (see, for example, Leveson et al. 2009; Roberts & Bea 2002; Weick & Sutcliffe 2008) or, recovers successfully to a state of normalcy after a disruption (see, for example, Bhamra, Dani & Burnard 2011; Dalziell & McManus 2004; Omer et al. 2012) or, adapts itself to changed circumstances so as to continue functioning (see, for example, Hamel & Välikangas 2003; Seville 2017). This study will provide a holistic definition of resilience that incorporates various perspectives on organisational performance under disruptions and threats. A holistic definition of organisational resilience may provide greater clarity to decision-makers in understanding the strategic implications and value of resilience. Such understanding may assist decision-makers in assessing the impact on their company's resilience from actions taken that are motivated by factors other than the quest for resilience.

1.4 Structure of the thesis

Following this introductory Chapter One, Chapter Two reviews existing literature to explore the meaning of organisational resilience. Due to the paucity of literature pertaining to resilience of shipping companies, the chapter draws upon empirical and theoretical studies from diverse fields to establish the construct of organisational resilience. Chapter Three continues the review of literature to identify organisational capabilities that contribute to resilience. Activities that influence the development of

resilience capabilities are discussed to form the basis of questions used during data collection.

Chapter Four explains the research design and methodology utilised to answer the PRQ and SRQs. The sampling decision to survey senior managers of shipping companies operating in Australia is justified together with the method of data collection from the sample. A survey instrument is developed, drawing upon the literature reviews in Chapter Two and Chapter Three. The Chapter explains the survey administration process utilised and closes with a discussion on measures taken to control both systematic and random errors.

Chapter Five is the first of two chapters containing the findings of the survey and analysis of data obtained. The chapter starts with a discussion on response rates and respondents' characteristics. The chapter partly addresses SRQ1 by exploring the resilience capabilities utilised to cope with actual disruptions. The analysis is continued in Chapter Six which addresses all three SRQs by reporting and discussing the extent of activities occurring in shipping companies that contribute towards resilience capabilities.

The thesis concludes with Chapter Seven that summarises the findings and conclusions from this exploratory study to answer the primary and secondary research questions. The purpose of the research is reiterated to contextualise the findings. The value of the study is highlighted, both in terms of its contribution to theory and contribution to management practice in shipping. The chapter ends by outlining potential limitations of this study and identifying areas of future research. Figure 1-1 provides a graphical illustration of the structure of the thesis.

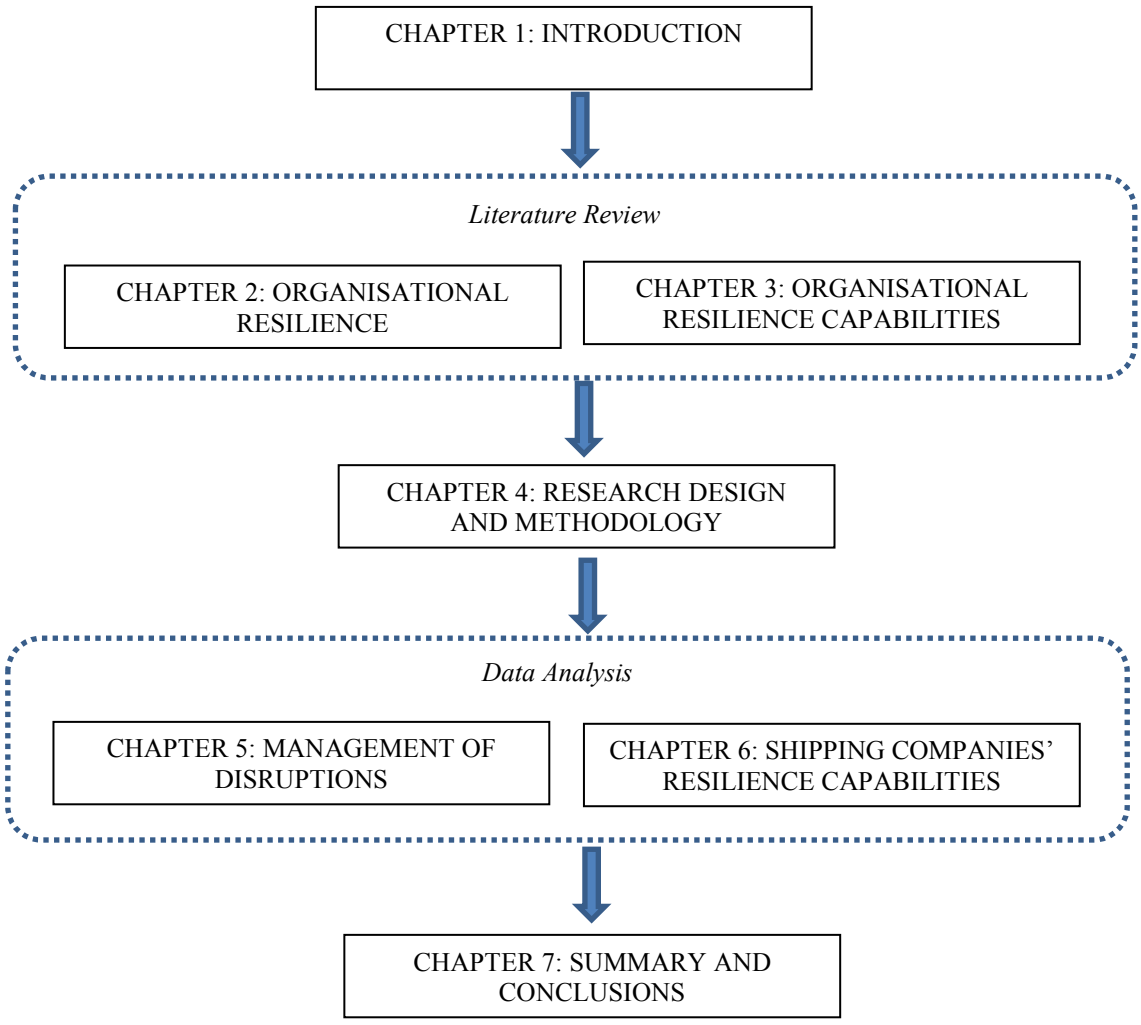


Figure 1-1: Structure of the Thesis

CHAPTER 2: ORGANISATIONAL RESILIENCE

2.1 Introduction

The notion of resilience has been conceptualised and applied across a variety of contexts in diverse disciplines including physics, psychology, economics, engineering, ecology, health science and social science. In organisational studies, resilience has been applied to a range of diverse fields such as risk management (Lirn & Shang 2015), safety management (Tillement, Cholez & Reverdy 2009), reliability management (Weick & Sutcliffe 2008), crisis management (Boin & McConnell 2007), disaster management (Paton, Kelly & Doherty 2006), human resource management (Ho et al. 2014), supply chain management (Sheffi & Rice 2005) and business management (Linnenluecke 2017). In the context of organisations, subjects of study include individuals (Coutu 2002), organisational entities (Seville 2017), communities (Comfort et al. 2001), nations (Oxford Metrica 2015) and regions (Pendall, Foster & Cowell 2010). Although the term resilience has become an increasing part of scholars' vocabulary since the beginning of the 21st century, there appears to be no universally shared meaning of organisational resilience among scholars.

This chapter reviews the literature on organisational studies to identify and discuss the multiple meanings attached to the notion of organisational resilience under diverse contextual and epistemological foundations. In order to develop a definition of resilience for this thesis, the chapter explores how theories and definitions of organisational resilience vary with scholars' differing perspectives on viewing organisations as systems, the conceptual frameworks utilised, scholars' normative stance, and spatial and temporal boundaries of the phenomenon studied. The chapter concludes by developing an abstract definition of organisational resilience that is used in this thesis to help answer the research questions.

2.2 A system's view of organisational resilience

In organisational studies, the notion of organisational resilience generally relates to how organisations cope with unforeseen and undesirable situations that are severe enough to threaten their viability and survival (see, for example, Hamel & Välikangas 2003; Hollnagel 2014; Lee, Vargo & Seville 2013; McDonald 2006; McManus 2008; Seville 2017; Sundstrom & Hollnagel 2006; Sutcliffe & Vogus 2003). The impacts of such adverse situations on organisations are variously described as disturbances (Hollnagel 2014), disruptions (Madni & Jackson 2009), shocks (Boin & van Eeten 2013), stresses (Gallopín 2006), malfunctions (Duijnhoven & Neef 2014) or perturbations (Fiksel 2003) that can lead to organisational crises and potentially disastrous consequences for affected stakeholders. Notwithstanding the variations in descriptions of impact, organisational studies on resilience are primarily focussed on disruptions to the normal functioning of organisations.

In organisational studies, central to the notion of resilience is the idea that disruptions, or threats of disruptions, arise due to organisations being confronted by a complex set of circumstances (see, for example, Hollnagel 2014; McDaniel 2007; Normandin & Therrien 2016; Palmberg 2009; Perrow 1984; Ryan 2009; Wesnser 2015). Complexity results from dynamic interactions between constituents of organisations' internal and external environments (Lansing 2003). Modern organisations face increased challenge of complexity due to 'the development of increased interconnectedness, transparency, empowerment of individuals, speed of transactions, and decreased cost of information' (Palmberg 2009, p. 484). Increasing complexity brings greater challenges in managing risks and preventing failures (Perrow 1984). As McDaniel (2007) explains, complexity creates uncertainty, unpredictability and surprise because there are limits to the extent to

which human the mind can formulate and solve complex problems. Hence it is difficult to anticipate complex situations and prepare organisations to confront disruptions (Hollnagel 2014).

Ryan (2009) suggests that most organisations employ a hierarchical structure to separate and solve problems that arise at different scales. Ryan (2009) argues that complex problems cannot be solved at a single scale due to interactions, trade-offs and relationships between different parts of an organisation. Ryan's (2009) view that complex problems require a holistic assessment of context is shared by several scholars who conceptualise organisations as systems to explore disruption management within organisations (see, for example, Cooke & Rohleder 2006; Leveson et al. 2009; Mamouni Limnios et al. 2014; McDonald 2006; Sundstrom & Hollnagel 2006; Witmer & Mellinger 2016). Two distinct conceptualisations of organisations as systems can be observed in organisational studies – organisations as socio-technical systems and organisations as complex adaptive systems. These conceptualisations lead to differences in the way scholars conceptualise resilience, and are discussed as follows.

2.2.1 Resilience in socio-technical systems

People use technological artefacts to perform purposeful tasks at their workplace (Trist 1981). The interrelatedness and complex interaction between the social and technical aspects of an organisation can be conceptualised as a socio-technical system (STS) (Trist 1981). Disruptions arising from complex social and technical interactions have been explored by several scholars who have focussed their attention on organisations which must remain accident free due to the potential for large scale destruction or disruption to essential services brought about by accidents (see, for example, Bain 1999; Boin & van Eeten 2013; Cooke & Rohleder 2006; Gephart 2004; Hollnagel 2014; Leveson et al. 2009;

Madni & Jackson 2009; Perrow 1984; Rijpma 2003; Roberts 1990; Roe & Schulman 2012; Sagan 1993; Weick 2010; Wesnser 2015). Studies of accidents and disasters in STS have led to the formulation of two well-known theories – the normal accident theory (NAT) and the high reliability theory (HRT) (Cooke & Rohleder 2006; Lee, Vargo & Seville 2013; Leveson et al. 2009; Rijpma 2003).

Perrow (1984) is credited with laying the foundations of the normal accident theory (NAT) (Bain 1999; Cooke & Rohleder 2006; Leveson et al. 2009; Rijpma 2003). According to Perrow (1984), accidents are inevitable in complex STS such as maritime transport. The inevitability of accidents arises due to interactive complexity and tight coupling of the system (Perrow 1984). The more technology is incorporated into a system, the greater is its interactive complexity (Cooke & Rohleder 2006). In complex systems, independent failures interact unexpectedly, and due to tight coupling, these interactions escalate rapidly into the breakdown of the system. According to Perrow (1984) small failures can spread rapidly to damage the larger system and cause accidents. Essentially, NAT proposes that some system responses to changes cannot be foreseen. As a result, some unforeseen responses can cause accidents, potentially leading to catastrophes (Cooke & Rohleder 2006). Such accidents can be viewed as 'normal' because the 'interdependencies in a system are so great that one small glitch in one place can lead to a large failure somewhere else' (Roberts, Bea & Bartles 2001, p. 71). In other words, normal accidents occur because multiple component failures in a system interact in unanticipated ways (Gephart 2004).

A competing organisational theory of accidents – high-reliability theory (HRT) – maintains that even though some accidents may be normal, the frequency and severity of disasters can be minimised (Cooke & Rohleder 2006; Perrow 1994; Rijpma 2003; Roberts, Bea & Bartles 2001; Sagan 1994). According to Rijpma (2003), in the mid-1980s

HRT emerged from studies of so called high reliability organisations (HROs) by a group of researchers at Berkley University. The Berkley University researchers investigated why HROs such as a company operating both a nuclear power station and electricity distribution network, US Navy aircraft carriers, and US air traffic control centres, were able to avoid catastrophic failure even though they operated hazardous technology (see, for example, La Porte & Consolini 1998; Roberts 1990; Rochlin, La Porte & Roberts 1987). Such organisations are considered reliable because they have the ability to 'manage hazardous technical systems safely and without serious error' over long periods (Schulman et al. 2004, p. 14). There is now increasing interest among stakeholders on the reliability and resilience of critical infrastructure that provides essential societal services such as large engineered supplies for water, electricity, telecommunications and transportation (Roe & Schulman 2012).

HROs maintain safety and reliability by anticipating and planning for unexpected disruptions (Madni & Jackson 2009). Research on HROs suggests that certain organisational characteristics and processes can assist resilient organisations prevent small problems from escalating into crises or disasters (Boin & van Eeten 2013). Roberts, Bea and Bartles (2001, p. 71) distil research on HROs to provide the following prescriptions for maintaining reliability:

- HROs aggressively seek to know what they don't know.
- HROs design their reward and incentive systems to recognise costs of failures as well as benefits of reliability.
- HROs consistently communicate the big picture of what the organization seeks to do, and try to get everyone to communicate with each other about how they fit the big picture.

Leveson et al. (2009) raise doubt about the generalisability of findings from HRO studies to organisations operating in competitive industries. Unlike HROs, the mission of most organisations is something other than safety (Leveson et al. 2009). The nature of the mission of HROs means that other goals of an HRO have limited impact on its safety goals, whereas for organisations operating in competitive environments, the organisational mission may not be achieved by designing systems and operations for lowest risk (Leveson et al. 2009). However, Waller and Roberts (2003) provide a counter argument, maintaining that organisations other than HROs can learn from HROs how to manage unexpected events in a fast changing, dynamic and complex environment. In particular, Waller and Roberts (2003) emphasise that HROs are exemplars of making quick decisions based on imperfect data and abandoning business as usual routines for improvisation.

In addition to research on HROs, concern with safety and reliability has led to the emergence of a new discipline within engineering, called resilience engineering (Madni & Jackson 2009). Resilience engineering explicitly assumes that it is possible to build systems that can avoid accidents through adjustment, monitoring, learning and anticipation (Hollnagel 2014; Madni & Jackson 2009). The distinction between HRT and resilience engineering however is unclear. Studies of HROs and analyses of accidents under NAT provides indications on why some organisations may fail and others may survive. Proponents of both HRT and resilience engineering paradigms share the view that exercising control over organisational systems, processes and behaviour is the best way to achieve safety and reliability. This view contrasts with the NAT paradigm which highlights the limitations of human control. NAT suggests that complexity, coupling and bounded rationality diminish human ability to influence how organisations cope with unexpected circumstances. The perceived limitations of human control on organisational

behaviour has led some scholars to suggest that organisations should be managed as complex adaptive systems (CAS) to cope with uncertainty and unpredictable change. The following section discusses the conceptualisation of resilience in complex adaptive systems.

2.2.2 Resilience in complex adaptive systems

Several scholars suggest that conceptualising organisations as CAS can assist in managing organisations to cope with unforeseen and unexpected circumstances arising out of complexity (see, for example, Bovaird 2008; Hammer, Edwards & Tapinos 2012; Jansen, Cammock & Conner 2011; McDaniel 2007; McKenzie 2014; Palmberg 2009; Ryan 2009; Schneider & Somers 2006; Wheatley 2008). CAS are made up of interconnected and interdependent agents who interact in dynamic, non-linear ways (Palmberg 2009). Non-linearity arises because the agents interact with each other via a web of feedback loops whereby both positive and negative feedbacks can take place (Anderson 1999; McDaniel 2007). Non-linear interactions mean that a system can exist in many possible alternative states (Ryan 2009). Under the CAS paradigm, change can be chaotic, and resilience is associated with continual adaptation in response to disruptions and threats of disruptions (Folke 2006). Although CAS are unpredictable, it is still possible to find order in their behaviour (Palmberg 2009).

A characteristic feature of CAS is the phenomenon of self-organisation (Alaa 2009; Anderson 1999; Bovaird 2008; Jansen, Cammock & Conner 2011; Lansing 2003; McDaniel 2007; Paley 2007). Self-organisation refers to the formation of holistic patterns of structures or behaviours from individual agents acting in their own interest, but little control from the top hierarchy (Anderson 1999; Paley 2007). Even though the agents act independently, self-organisation occurs as a result of positive feedback loops whereby

some behaviours are amplified over others, leading to collective behaviour (Anderson 1999; Paley 2007). In response to a threat or opportunity, independent agents self-organise to create emergence (Alaa 2009; Holland 1992; Lansing 2003). Emergence means that 'the characteristics or phenomena of the whole appear due to the collective behaviour of the system' (McKenzie 2014, p. 2). Emergence is unpredictable and is therefore a major source of surprise in CAS (Bovaird 2008; McDaniel 2007; McKenzie 2014). In addition to self-organisation and emergence, CAS co-evolve with their environment such that by changing themselves, CAS change the environment around them (Alaa 2009; McDaniel 2007).

Both in studies of STS and CAS, the systems are conceptualised as complex systems whose parts interact in unpredictable ways. CAS however differ from STS because agents in CAS are capable of self-organisation as stated previously. This leads to differences in the way managerial control and planning can be exercised in STS and CAS. As McDaniel (2007, p. 27) explains:

> Control can be seen as an effort to determine, through the use of feedback, if the system is doing what it is supposed to be doing – are goals being met. Planning is the process of making decisions, based on predictions of future system states, about what to do now to achieve desired goals in the future. Each of these tasks requires the ability to forecast future states of nature, but in CAS this is usually impossible [due to self-organisation and emergence].

Folke (2006) suggests that in STS, resilience is achieved by controlling change, whereas in CAS, managers can only manage the system's capacity to cope with change.

2.3 Conceptual frameworks of resilience

There appears to be consensus among scholars such as Annarelli and Nonio (2016), Folke (2006), Gunderson (2000), Manyana (2006), Paton, Kelly and Doherty (2006) and Ponomarov and Holcomb (2009) that ecologist Holling (1973) was one of the first

scholars to emphasise the importance of resilience as a distinct property of complex systems. Holling's (1973) seminal work acknowledged that a system can exist in a multitude of states rather than simply one state of equilibrium. Accordingly, a system can move from one equilibrium state to another if the disruption is large enough. Utilising Holling's (1973) explanation of multiple equilibrium states of a system, Martin-Breen and Anderies (2011) and Pendall, Foster and Cowell (2010) identify three conceptual frameworks that shape scholars' understanding of the meaning of resilience. The first framework considers a system as existing in a single-equilibrium state, the second framework acknowledges the existence of multi-equilibrium states of a system, and the third framework considers systems as CAS. These frameworks are discussed below.

2.3.1 The single-equilibrium resilience framework

Many definitions of resilience relate to the ability of a system to 'rebound, return, or recover its original state, structure, equilibrium, or state of nature' when exposed to a disruption (Schoon 2005, p. 3). Thus the linkage to Manyana's (2006) explanation that the term resilience is derived from the Latin word 'resilio' which means to jump or bounce back. The single-equilibrium framework emphasises the return to normalcy or business as usual following a disruption. Resilience in this case means withstanding a disruption by returning to a state of normalcy or business-as-usual quickly; without changing, collapsing, or becoming permanently damaged (Martin-Breen & Anderies 2011). Thus, for example, Wreathall (2006, p. 275) defines resilience as 'the ability of an organisation (system) to keep, or recover quickly to, a stable state, allowing it to continue operations during and after a major mishap or in the presence of continuous significant stresses'. This kind of resilience has been termed engineering resilience by Holling (1996) and Martin-Breen and Anderies (2011). The naming of engineering resilience arises from

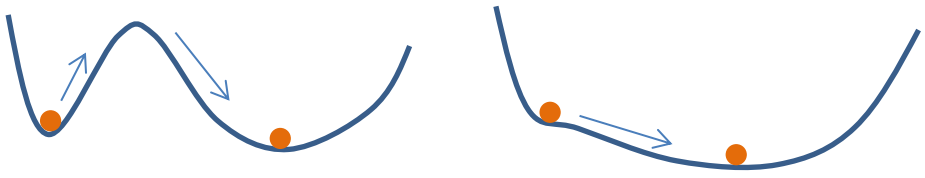
'traditions of engineering, where the motive is to design systems with a single operating objective' (Gunderson 2000, p. 426).

Folke (2006) explains that engineering resilience is about resisting change and this resistance is often addressed in terms of recovery. Engineering resilience is based upon the assumption that there is only one state of equilibrium, or normal state, for a system, and resilience can be measured by the speed with which the system returns to the stable point following a disruption (Gallopín 2006; Gunderson 2000). Thus, for example, Haimes (2006, p. 294) defines resilience as 'the ability to recover the desired values of the state of the system that has been attacked, within an acceptable time period and at an acceptable cost'. Hence, engineering resilience focusses on efficiency, constancy, and predictability (Holling 1996).

2.3.2 The multiple-equilibrium resilience framework

The single-equilibrium framework fails to take into account situations where changes occurring in a system's environment may make a return to a pre-disruption state either impossible or undesirable. The multiple-equilibrium framework acknowledges that: a) a large enough disruption can flip a system from one state to another, and b) a system can adapt to a new equilibrium if changes in the system's environment necessitate it (Folke et al. 2010; Gunderson 2000; Holling 1996; Pendall, Foster & Cowell 2010). Gunderson (2000) uses the heuristic of a ball and cup to illustrate resilience under the multi-equilibrium framework. As shown in Figure 2.1, the ball represents a system and the cup represents the region where the system can maintain a particular state. When the ball is at the bottom of the cup, it is in a stable state. If disturbed, the ball will tend to roll back to the bottom of the cup. However, if the disturbance is large enough, the ball will roll over

the edge of the cup to another cup as shown in Figure 2-1 (a). Another way that the ball can move to a new state is if the shape of the cup changes as shown in Figure 2-1 (b).



(a) Transition due to disturbance

(b) Transition due to changed landscape

Figure 2-1: Ball and cup heuristic of multi-equilibrium system

Source: Adapted from Gunderson (2000, p. 427) and Bhaskar, Cahoon and Chen (2014, p. 305)

The magnitude of disturbance that a system can absorb before it changes from one state to another has been termed 'ecological resilience' (Folke et al. 2010; Gunderson 2000; Holling 1996; Pendall, Foster & Cowell 2010). Holling (1996, p. 33) contrasts ecological resilience with engineering resilience by stating that engineering resilience focuses on 'maintaining *efficiency* of function' whereas ecological resilience focuses on 'maintaining *existence* of function'. Martin-Breen and Anderies (2011, p. 7) provide a similar definition based on system function by defining resilience as 'maintaining system function in the event of a disturbance' but term it as 'systems resilience' rather than ecological resilience.

The definition of ecological resilience does not include the adaptation or change that a system may undergo if the environment (landscape) changes as shown in Figure 2-1 (b). Folke et al. (2010) provide a comprehensive definition of resilience which maintains focus on system function, and in addition, includes the system capacity to change. Folke et al. (2010, p. 3) define resilience as:

> …the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and

feedbacks, and therefore identity, that is, the capacity to change in order to maintain the same identity.

Folke et al.'s (2010) definition highlights the dual capabilities of resilient systems – ability to absorb disturbance and ability to change. These dual capabilities are also highlighted in definitions by Adger (2006), Arsovski et al. (2017), Fiksel (2003) and Madni and Jackson (2009) shown in Table 2-1 which contains a selection of resilience definitions to illustrate variances in conceptualising resilience under the multiple-equilibrium framework.

Table 2-1: Resilience definitions under multiple-equilibrium framework

Author(s)	**Resilience definition**
Adger (2006, p. 268)	'resilience refers to the magnitude of disturbance that can be absorbed before a system changes to a radically different state as well as the capacity to self-organise and the capacity for adaptation to emerging circumstances'
Anderies, Janssen and Ostrom (2004, p. 1)	'resilience…measures the amount of change or disruption that is required to transform the maintenance of a system from one set of mutually reinforcing processes and structures to a different set of processes and structures'
Arsovski et al. (2017, p. 410)	'the ability of an organisation to withstand systematic discontinuities as well as having the capability to adapt to new risk environment'
Burnard and Bhamra (2011, p. 5595)	'resilience is an emergent property that relates to the inherent and adaptive qualities that enable an organisation to take a proactive approach to threat and risk mitigation'
Cumming et al. (2005, p. 976)	'the ability of a system to maintain its identity in the face of internal change and external shocks and disturbances'
Fiksel (2003, p. 5332)	'the capacity to resist disorder…a resilience system through adaptation and evolution…is capable of surviving large perturbations'
Folke et al. (2010, p. 3)	'the capacity of a system to absorb disturbance and reorganize while undergoing change'
Hamel and Välikangas (2003, p. 2)	'the capacity to change before the case for change becomes desperately obvious'
Levin and Lubchenco (2008, p. 27)	'the capacity of systems to keep functioning even when disturbed'
Madni and Jackson (2009, p. 187)	'resilience is a multi-faceted capability of a complex system that encompasses avoiding, absorbing, adapting to, and recovering from disruptions'
McManus (2008, p. 5)	'resilience is a function of an organisation's situation awareness, identification and management of keystone vulnerabilities and adaptive capacity in a complex, dynamic and interconnected environment'
Seville (2017, p.18)	'resilient organisations understand the need to be able to change and adapt quickly, not just to crises but to any form of change happening in their word'

Seville, Opstal and Vargo (2015, p.6)	'resilience is…about creating the agility needed to adapt to unexpected challenges'
Sundstrom and Hollnagel (2006, p. 235)	'an organisation's ability to adjust successfully to the compound impact of internal and external events over a significant time period'

Anderies, Janssen and Ostrom's (2004) definition for example follows the definition of ecological resilience while Cumming et al.'s (2005) and Levin and Lubchenco's (2008) defnitions focus on maintaining function. Burnard and Bhamra (2011), Fiksel (2003), Hamel and Välikangas (2003), McManus (2008), Seville (2017) and Sundstrom and Hollnagel (2006) highlight the ability to adapt as a key system capability for resilience. Madni and Jackson's (2009) reference to recovery suggests that the ability to withstand disruptions may need to include the capacity for engineering resilience. The above definitions illustrate that despite differences in the manner that resilience is conceptualised under the multi-equilibrium framework, the ability of a system to adapt to changing circumstances is a key aspect of resilience.

2.3.3 The CAS resilience framework

Resilience in CAS has been theorised as continual adaptation of systems to change, without any reference to equilibrium states (Berkes, Colding & Folke 2002; Darnhofer, Fairweather & Moller 2010). The changes that CAS undergo over a period of time can be illustrated through the heuristic model of 'adaptive cycle' (Holling 2001). The adaptive cycle is conceived as a continuous cycle of growth, maturity, crisis and renewal where system sustainability means a persistent pattern of change rather than a steady state (Berkes, Colding & Folke 2002; Darnhofer, Fairweather & Moller 2010; Folke et al. 2010; Holling 2001). In the adaptive cycle, a system commonly moves from a phase of growth where resilience is high and resources freely available, into a phase where there is little flexibility due to increasing rigidity of the system, followed by a sudden collapse

into a phase of chaotic dynamics that finally leads to a phase of reorganisation (Holling 2001). The four phases are referred to as exploitation (r), conservation (K), release (Ω) and reorganisation (α) phases respectively (Holling 2001). As shown in Figure 2-1, the r and K phase form the so called forward loop that is characterised by a fairly predictable pattern of growth whereas the Ω and α phases form the so called back loop characterised by unpredictability and reorganisation (Scheffer 2009). CAS spend most of the time progressing along the forward loop, becoming increasingly efficient but less flexible until inevitably, the conservation phase ends, triggered by a shock (Walker & Salt 2006). The longer the conservation phase, the smaller the shock required to end it (Walker & Salt 2006).

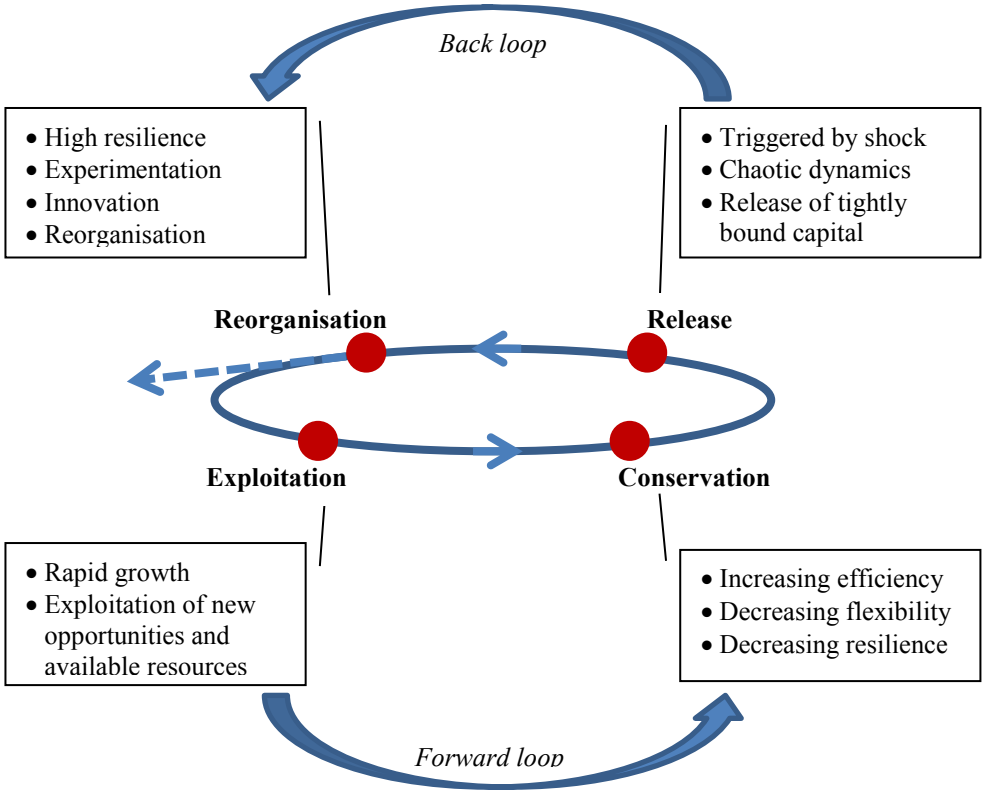


Figure 2-2: The adaptive cycle

Source: Adapted from Berkes, Colding and Folke (2002), Holling (2001) and Bhaskar, Cahoon and Brooks (2014)

The adaptive cycle model shows that at different phases of the cycle, the resilience of the system increases and decreases. The lesson for organisations from the adaptive cycle model appears to be that when a system becomes over-connected and increasingly rigid in its control, it becomes an accident waiting to happen (Holling 2001).

There are similarities between the adaptive cycle model and the notion of creative destruction in economics that is attributed to Joseph Schumpeter (Banks & Cunningham 2016; Komlos 2016). Opportunities for innovations such as new products, new relationships, and new business processes arise following a period of chaotic change and reorganisation – a period of creative destruction. Banks and Cunningham (2016) illustrate creative destruction with the example of the Australian videogame industry where game developers have adapted from videogames on propriety devices to games on mobile apps. Hamel and Välikangas (2003, p. 55) note that 'rather than go from success to success, most companies go from success to failure and then, after a long, hard climb, back to success'.

Adaptive cycles operate over many different temporal and spatial scales, in the form of a hierarchical set of nested adaptive cycles termed panarchy (Holling 2001; Walker et al. 2004) as shown in Figure 2-3. According to Holling (2001) the sustainability of a system is determined by the functioning of these cycles and the communication between them. Two interactions between the adaptive cycles at different levels of the panarchy, 'revolt' and 'remember', are particularly important. The revolt interaction represents the situation whereby a critical change in one system, which is at the release phase of its cycle, may cascade up to the next higher and slower level and trigger a crisis at its conservation phase where resilience is low (Folke 2006; Holling 2001). The remember interaction represents the situation whereby a system, which is at the renewal phase of its cycle following a crisis, may be able to draw upon the potential accumulated and stored by the larger slower

level above it which is at its conservation phase (Folke 2006; Holling 2001). The memory of the system, that is, its accumulated experience and history, provides the source for renewal and reorganisation following a disturbance (Berkes, Colding & Folke 2002). A healthy system is invigorated from below by smaller, faster cycles of innovation, while being protected by the accumulated processes and resources of the slower, larger levels above (Holling 2001).

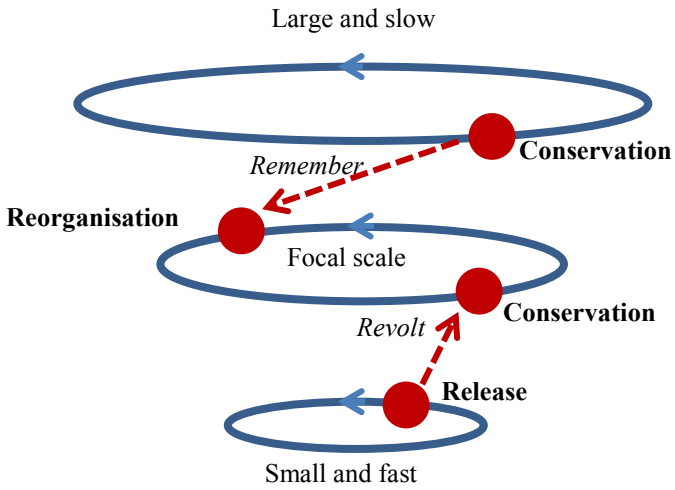


Figure 2-3: Panarchical connections

Source: Adapted from Holling (2001) and Bhaskar, Cahoon and Brooks (2014)

The cross scale interactions in panarchy illustrate how system sustainability is affected by the interplay between change and persistence. Innovations and new ideas created during the release and renewal phases of the adaptive cycle drive changes at the scale above via the revolt connection, whereas persistence is facilitated by the remember connection (Holling 2001). Panarchy suggests that resilience at a particular scale is affected by scales above and below the reference scale (Vonck & Notteboom 2016).

2.4 Defining organisational resilience

The preceding sections have highlighted the multiple meaning attached to the meaning of resilience. Gunderson (2000, p. 425) remarks that 'since most management actions are based upon some type of theory, these multiple meanings of resilience can lead to very different sets of policies and action'. Considering the PRQ developed for this thesis: *How can shipping companies develop organisational resilience capabilities?* a clear definition of organisational resilience is necessary. Carpenter et al. (2001, p. 767) suggest that any study of resilience needs to clarify resilience 'in terms *of* what and *to* what'. Such clarification should take into account the spatial and temporal scales of the system being studied (Carpenter et al. 2001). The multiple meanings of resilience discussed in the preceding sections are influenced by both space and time. For example, studies of HROs consider the resilience of safety and reliability systems within organisations and not necessarily the organisational entities themselves. Engineering resilience with its focus on quick recovery is applicable over short time scales. Resilience under the multiple-equilibrium framework however, takes into account changes occurring slowly (Martin-Breen & Anderies 2011) and therefore applies over longer time scales.

As the unit of analysis in this study is the organisation (shipping company) consideration of the resilience *of* what question requires clarifying what constitutes an organisation. Puranam, Alexy and Reitzig (2014, p. 163) observe that various conceptualisations of organisations in literature contain common features whereby an organisation may be portrayed as: '(1) a multi-agent system with (2) identifiable boundaries and (3) system-level goals (purpose) towards which (4) the constituent agent's [sic] efforts are expected to make a contribution'. Utilising Puranam, Alexy and Reitzig's (2014) explanation, an

organisation's boundaries may be identified with reference to the assets it owns and its employment contracts with employees (Puranam, Alexy & Reitzig 2014). However, at any given time, for the same amounts of organisational assets and employees, an organisation may exist in one of a number of alternative states. An organisation can be in a healthy state, unhealthy state or in a catastrophic state (Sundstrom & Hollnagel 2006).

The definitions of resilience discussed in the preceding sections highlight resilience as a normative concept – a desirable capability that enables an organisation to perform in a desirable way such as recovering or adapting successfully from disruptions. As Hamel and Välikangas (2003, p. 54) state, the aim of resilience should be that organisations can undergo change without trauma 'where revolutionary change happens in lightening quick, evolutionary steps – with no calamitous surprises, no convulsive reorganisations, no colossal write-offs, and no indiscriminate, across-the-board layoffs'. Additionally, business organisations may utilise disruptive change to gain competitive advantage (Seville 2017). Therefore it becomes necessary to not only establish the resilience *of* what *to* what, but also *for* what purpose. Establishing the purpose can help identify which organisational state is being desired, and by whom. First however, it is necessary to identity the entity or person(s) from whose point of view the desirability of organisational resilience is being considered. For example, some terrorist organisations may be resilient (Wheatley 2008), but governments are hardly likely to find their resilience desirable. Taking another example, the capacity to withstand flooding is unlikely to be considered a resilience capability by a desert community for whom threat of flooding may not be relevant (Duijnhoven & Neef 2014). Therefore the understanding of resilience by a desert community is likely to differ from the understanding of resilience by a flood-prone community (Duijnhoven & Neef 2014).

Organisations are intentional systems (Hollnagel 2014), that is, they are set up for a purpose. It is logical to assume that the purpose is set by an organisation's shareholders and stakeholders. It follows therefore that the desired state of an organisation is one where it provides expected value to its shareholders and stakeholders (Fiksel 2003). Fischer and Zink (2012) conceptualise organisations as entities that convert inputs into outputs to meet defined purpose. Resilience links organisational resources and capabilities to outcomes (Burnard & Bhamra 2011). Hence disruptions may be conceived as situations that disrupt the conversion of inputs into outputs that provide value to shareholders and stakeholders. Furthermore, as discussed previously, when disruptions are caused by unforeseen, unpredictable and unfamiliar situations, organisations may be unable to rely on plans based that are based on identifiable risks and predictable situations (Friedman 2005; Leveson et al. 2009; McDaniel 2007; Parsons 2010). For parsimony, this Thesis uses the term 'unexpected disruptions' to refer to disruptions caused by unforeseen, unpredictable and unfamiliar situations.

Based upon the preceding discussion, the meaning of organisational resilience used in this thesis is as follows:

> *Organisational resilience is the ability of an organisation to maintain functionality in a disruptive environment. Maintaining functionality means that an organisation continues to provide value and fulfil expectations – in the manner, and over a period of time – as determined by its shareholders and stakeholders.*

By focussing on functionality, the above definition attempts to reconcile the apparent tension between change and stability evident in the literature (Linnenluecke 2017). In order to maintain functionality, an organisation may need to adapt in response to, or in

anticipation of, change occurring in its environment. Over shorter time scales however, an organisation must be capable of recovering from any disruption experienced.

As discussed previously in section 2.2, organisations can be conceptualised as systems. Such systems are open systems because they receive input and feedback from external entities (Stenval & Virtanen 2017). Accordingly, a shipping company is conceptualised in this thesis as an open system as shown in Figure 2-4. The shipping company takes inputs from a variety of sources such as ship sale and purchase market, labour market and technology to provide shipping service that creates value for its shareholders, customers and stakeholders. Double-headed arrows in Figure 2-4 indicate that the interaction between various entities is not one-directional. For example, shipping companies are impacted by the freight market but can, in turn, affect the freight market with their actions such as expanding or reducing their fleet capacity (Papapostolou, Pouliasis & Kyriakou 2017). As suggested by various scholars (see, for example, Hollnagel 2014; McDaniel 2007; Palmberg 2009; Perrow 1984; Ryan 2009; Wesnser 2015), these dynamic interactions between the shipping company and its input suppliers and output receivers as well as the interactions between various entities with the economic, social and ecological environments create complexity and uncertainty for decision-makers. This complexity and uncertainty may make it difficult for managers of shipping companies to foresee and therefore plan for any disruption to the conversion of inputs into outputs that provide value to their shareholders, stakeholders and customers.

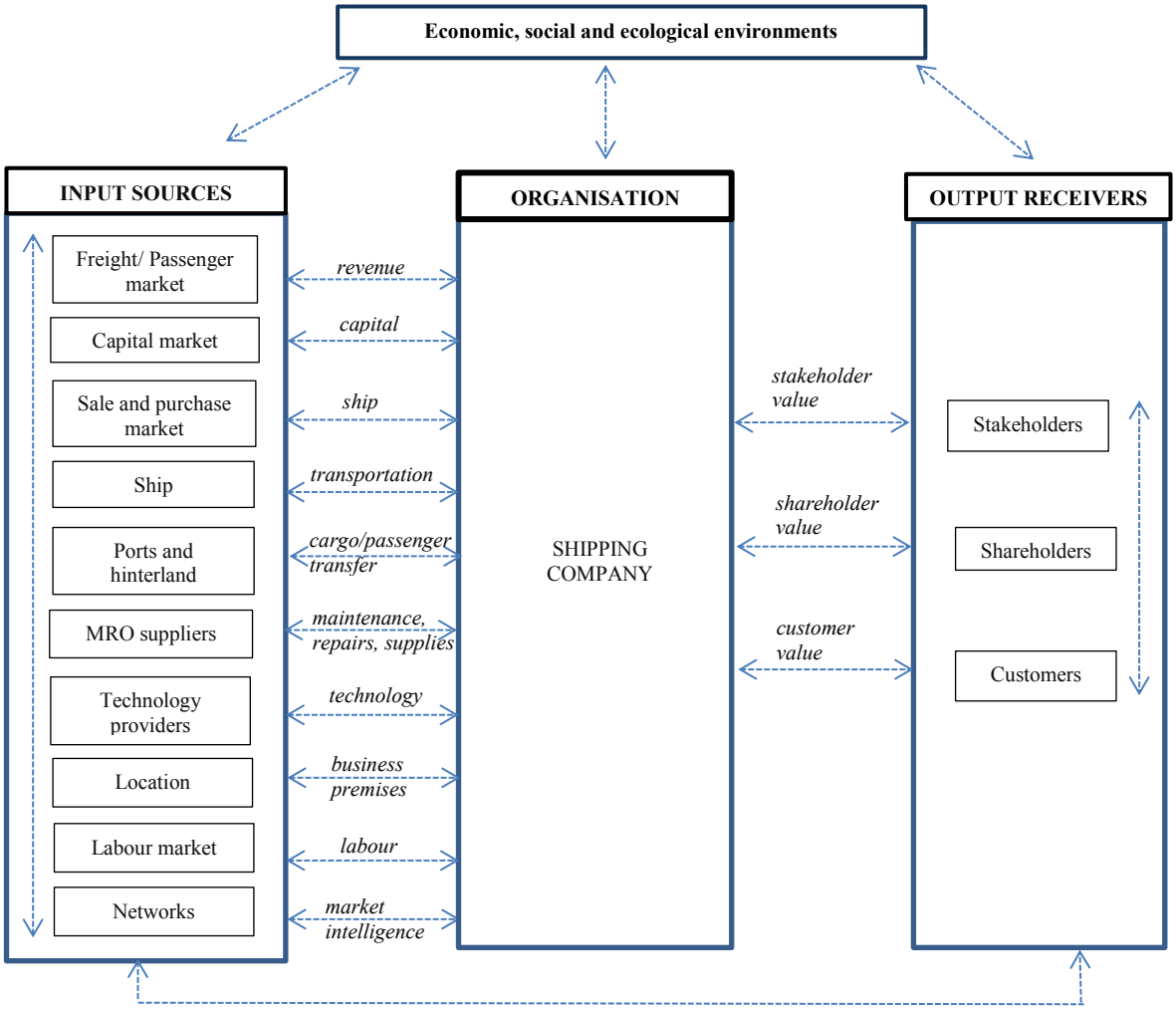


Figure 2-5: The shipping company as a system

Source: Adapted from Fischer and Zink (2012), Bhaskar, Cahoon and Brooks (2014)

2.5 Summary

The term resilience is commonly expressed in the context of disruptions faced by organisations. Resilience is often conceptualised as a normative concept – a desirable capability which enables an organisation to perform or behave in a desirable way when faced with adversity. There are however multiple meanings attached to resilience depending upon conceptualisation of organisations as STS or CAS, the conceptual

frameworks utilised to consider systems as existing in single or multiple equilibrium states and CAS, and applications of resilience in time and space. This chapter has provided a definition of organisational resilience which will be utilised to identify organisational resilience capabilities from the literature in the next chapter.

CHAPTER 3: ORGANISATIONAL RESILIENCE CAPABILITIES

3.1 Introduction

In Chapter Two, it was theorised that in a disruptive environment, a resilient organisation is able to maintain its functionality from a shareholder and stakeholder perspective. This chapter reviews extant organisational studies to identify organisational capabilities which contribute to the maintenance of functionality together with activities that support the development of such capabilities. The focus on functionality means that organisational capabilities and activities must be able to cope with disruptions and threats across multiple temporal and spatial scales to suit the purpose of shareholders and stakeholders. The chapter starts with a general discussion on the prescriptions for resilience provided in organisational studies. This is followed by a synthesis of literature to identify organisational capabilities and activities that contribute to resilience. The chapter ends with conceptualisation of organisational capabilities, their dimensions and indicators.

3.2 Prescriptions for resilience

As discussed in Chapter Two, several scholars highlight complexity as the main challenge facing organisations in coping with disruptions (see, for example, Comfort et al. 2001; Dahms 2010; Klockner 2017; Madni & Jackson 2009; McKenzie 2014; Palmberg 2009; Perrow 1984; Ritchie 2004). Complexity arises because constituents of an organisational system interact in non-linear ways to cause unpredictability, uncertainty and surprise for people (Lansing 2003; McDaniel 2007; Palmberg 2009; Ryan 2009; Uhl-Bien, Marion & McKelvey 2007; Witmer & Mellinger 2016). Hence organisations are often confronted with novel situations that they have not previously experienced and as a result, predetermined plans and procedures based on assumptions may not be adequate to cope with novelty (Boin & van Eeten 2013; Lagadec 1997; Leonard & Howitt 2012).

Accordingly, organisational resilience capabilities may be conceptualised as those capabilities that enable organisations to cope with challenges created by novelty.

According to Ambulkar, Blackhurst and Grawe (Ambulkar, Blackhurst & Grawe 2015) and Brandon-Jones et al (Brandon-Jones et al. 2014) the ability to leverage and reconfigure resources is a key organisational capability to recover from disruptions. Ponomarov and Holcomb (Ponomarov & Holcomb 2009, p. 134) and Ponomarov (Ponomarov 2012, p. 21) utilise a resource-based framework to state that the term capabilities 'reflects the major role of strategic management in adapting, integrating and reconfiguring resources, organisational skills and functional competencies to respond to the challenges of the external environment'. Such capabilities are dynamic and consist of 'those attributes, abilities, organisational processes, knowledge, and skills that allow a firm to achieve superior performance' (Ponomarov 2012, p. 21; Ponomarov & Holcomb 2009, p. 134). Pettit, Fiksel and Croxton (Pettit, Fiksel & Croxton 2010, p. 6) elaborate on the type of performance desired by stating that capabilities are 'attributes that enable an enterprise to anticipate and overcome disruptions'. Since resilience is an outcome that results from many activities undertaken in an organisation (Parsons 2010), organisational resilience capabilities may be broadly stated as those that enable an organisation 'to investigate, to learn, and to act, without knowing in advance what one will be called to act upon' (Sutcliffe & Vogus 2003, p. 97) at the same time ensuring that the organisation remains free of trauma or failure (Välikangas 2010).

In Chapter Two, it was also highlighted that the desired performance outcome from organisational response to a disruption varies with the conceptualisation of an organisation as either a single-equilibrium system, multiple-equilibrium system or CAS. When conceptualised as a single-equilibrium system, resilience means resisting change (Folke 2006). This implies that in single-equilibrium systems, the resilience capabilities

required by an organisation are those that assist in stability, that is, recovery following a disruption (see, for example, Annarelli & Nonino 2016; Haimes 2006; Wreathall 2006). As discussed in Chapter Two, under both multiple-equilibrium systems and CAS conceptualisations, the desirable performance outcome is the same – adaptation, however in CAS the adaptive cycle heuristic suggests that a system may undergo a period of chaotic change and reorganisation following a crisis (Holling 2001). Such reorganisation may lead to transformation of the system into a new system with new identity (Folke et al. 2010; Walker & Salt 2006). Martin-Breen and Anderies (2011) explain that a system's identity is the set of agents and relationships that constitute the system structure. The difference between adaptation and transformation is in the scale of change that the system undergoes. At the small end of scale, change may be temporary. For example, Boin and Eeten (2013) maintain that in an emergency, successful high reliability organisations are able to change their formal organisational structure into a decentralised team-based approach to problem solving. In this example, the change to the structure is not permanent and only lasts for the duration of the emergency. An example of change at much larger scales is provided by Fusillo (2006) who notes how shipping companies adapted to a US law which came into force in 1999, through mergers and acquisitions.

Depending upon the conceptual framework utilised, the organisational capabilities that contribute to resilience are those that contribute to stability (single-equilibrium systems) and change (multiple-equilibrium systems and CAS). The duality of stability and change leads Mamouni Liminos et al. (2014, p. 106) to describe resistance (which they refer to as 'defense') and adaptation (which they refer to as 'offence') as 'two opposing manifestations of resilience'. Mamouni Liminos et al. (2014) suggest that resilient organisations maintain a desirable state by balancing defense and offense. Mamouni Liminos et al.'s (2014) description highlights the temporal and spatial scales over which

resilience capabilities must maintain the desired functionality. Stability, with its focus on recovery is applicable over short time frames whereas adaptation occurs over longer periods. Similarly, Välikangas (2010) uses the terms operational resilience and strategic resilience to make temporal and spatial differentiation of resilience. According to Välikangas (2010) operational resilience is concerned with accident avoidance and recovery whereas strategic resilience is about turning threats into opportunities to ensure an organisation's long term survival and sustainability. In Madni and Jackson's (2009) view, there are two types of resilience – reaction and adaptation. According to Madni and Jackson (2009, p. 182) 'reaction implies immediate or short-term action while adaptation implies long-term learning'. The dual capability view of resilience is shared by practitioners in a study involving 50 chief executive officers of infrastructure companies in Australia (Commonwealth of Australia 2012). The study found that participants clearly distinguished between short term and long term resilience (Commonwealth of Australia 2012). In accordance with the stability/adaptation duality, short term resilience was typically viewed in relation to the ability of the organisation to deal with short term disruptions and shocks such as natural disasters, reputational damage or significant changes in market dynamics whereas long term resilience was viewed from a strategic direction and positioning perspective in the context of slowly occurring changes such as climate change, market trends and the regulatory environment (Commonwealth of Australia 2012).

While the literature abounds with prescriptions for resilience, there is a paucity of empirical research on the resilience of organisations where the purpose is to maintain functionality of the organisation. Empirical studies are largely confined to studies of HROs and socio-ecological systems that are CAS. As Mamouni Liminios et al. (2014, p. 106) note, 'there is little systematic work on organisational resilience that has received

independent attention'. A noteworthy study was conducted by Lee, Vargo and Seville (2013) who surveyed organisations in the Auckland region of New Zealand to develop a tool to measure and compare organizations' resilience. Lee, Vargo and Seville (2013) however do not provide a definition of resilience. Instead, Lee, Vargo and Seville's (2013) study provides a model of resilience based on two factors – adaptive capacity and planning – and 11 indicators. Lee, Vargo and Seville's (2013) model emphasises planning which suggests that the ability to anticipate may be a major capability for resilience in their model. In the absence of a definition, it is difficult to deduce if Lee, Vargo and Seville's (2013) model accommodates disruptive change that occurs slowly over the long term.

The following sections review the prescriptions for resilience in the literature and identify resilience capabilities by deductive reasoning. In light of the temporal and spatial ambiguities in the literature, this review is based upon synthesising findings from the literature either as those that appear to be independent of time and space or those that are limited to short time and spatial scales. The review suggests that the abilities of organisations to cope with disruptive novel situations that appear to be independent of time and space are those that enable organisations to:

- learn from dynamically unfolding situations (see, for example, Burnard & Bhamra 2011; Klockner 2017; McDaniel 2007; Sagan 1994; Senge 1990; Seville, Van Opstal & Vargo 2015; Stewart & O'Donnell 2007; Uhl-Bien, Marion & McKelvey 2007);
- develop awareness of the situation (see, for example, Dahms 2010; Lagadec 1997; Leonard & Howitt 2012; McManus 2008; Parsons 2010) and anticipate threats and opportunities (see, for example, Friedman 2005; Hollnagel 2014; Madni & Jackson 2009; Sheffi & Rice 2005); and

- devise solutions to problems and opportunities through innovation, improvisation and creativity (see, for example, Kamalahmadi & Parast 2016; Lalonde 2011; McDaniel 2007; McKenzie 2014; Sutcliffe & Vogus 2003; Uhl-Bien, Marion & McKelvey 2007; Wheatley 2008; Witmer & Mellinger 2016).

Should an organisation experience a disruption, over a short time scale, prescriptions from literature relate to organisational capabilities that enable quick recovery (Pearson & Clair 1998) and redundancy (Zsidisin & Wagner 2010). The prescriptions emphasise agility, that is, the ability of an organisation to react quickly (Christopher & Peck 2004; Hohenstein et al. 2015). Quick response also strengthens an organisation's competitiveness by recovering quicker than its competitors (Hohenstein et al. 2015). The aim of quick recovery is to maintain stability and therefore as suggested by Lalonde (2011), Madni and Jackson (2009), Mamouni Limnios et al. (2014) and Martin-Breen and Anderies (2011) the organisational capabilities for stability are grouped under the heading of robustness in this thesis. The following sections discuss learning, awareness (including anticipation), innovativeness (including creativity and improvisation) and robustness.

3.3 Learning

When confronted with novel situations in a disruptive environment, people within organisations face the challenge of taking appropriate actions to achieve desired outcomes because they have not experienced such situations previously (Friedman 2005; Klockner 2017; Leonard & Howitt 2012; Uhl-Bien, Marion & McKelvey 2007; Weick & Sutcliffe 2008). Friedman (2005) argues that when people are faced with unexpected novel situations that they have not faced before, they cannot rely on lessons from the past to make successful decisions because change in the modern era is no longer incremental and predictable. McDaniel (2007, p. 30) notes that 'people don't know what to do not because

they are incompetent but because they have not seen the situation before'. Uhl-Bien et al. (2007) add that unlike technical problems that are more characteristic of the industrial age and can be solved by existing knowledge and procedures, challenges arising from complexity are typical of the modern knowledge era and can only be solved by new learning and innovation. According to Uhl-Bien et al. (2007, p. 300) proven solutions can only be applied to known problems, hence organisations need to 'learn their way out of problems that could not have been predicted'. According to Darnhofer et al. (2010) the existence of uncertainty and surprise requires a continuous learning process whereby survival and growth depends upon successful generation and use of knowledge.

Bain (1999) notes that organisational learning is a key area of concern for both the NAT and HRT perspectives that deal with the management of hazardous technologies. Sagan (1994) observes that the literature on hazardous technologies commonly refers to three basic models of organisational learning:

- trial-and-error learning;
- artificial learning through the use of simulations and exercises; and
- vicarious learning from the mistakes of others.

Bovaird (2008), Leonard and Howitt (2012) and McKenzie (2014) apply trial-and-error learning and experimentation to all organisations, not just to those managing hazardous technologies, and state that trial-and-error learning involves taking a range of actions, evaluating the results, and shifting efforts towards things that appear to have a positive impact on the organisation. In order to obtain a wide range of possible options, Vogus and Sutcliffe (2003), McDaniel (2007) and Leonard and Howitt (2012) recommend increasing diversity among the workforce so that decision-making is informed by a wide variety of perspectives. McDaniel (2007) does however acknowledge that in some

organisations, diversity may be viewed as a source of inefficiency as well as conflict. Similarly, Darnhofer et al. (2010) suggest that learning benefits when experimental knowledge is combined with experiential knowledge gained from diverse information sources and perceptions.

Many scholars hold the view that organisations need to learn from failed approaches, mistakes and near-failures (see, for example, Hopkin 2014; Lagadec 1997; Pearson & Mitroff 1993; Ritchie 2004; Sheffi & Rice 2005). However, failure may not necessarily be acknowledged or accepted readily within organisations (Lagadec 1997). Often people who admit to failure or that they cannot control outcomes are penalised (McKenzie 2014). Hence for learning to take place, it is necessary to have an organisational culture where people feel safe enough to tell the truth about what actually works (Garvin, Edmondson & Gino 2008; Hopkin 2014; McDaniel 2007; McKenzie 2014). Pearson and Mitroff (1993, p. 54) refer to a 'no fault learning' approach whereby organisations should refrain from finding scapegoats to assign blame so that all pertinent information can surface. The emphasis should be on developing future capabilities from the lessons learnt (Pearson & Mitroff 1993). Garvin (1993) recommends that organisations should set up processes for periodical reviews of past successes and failures and the lessons learnt should be recorded and freely made available to staff. Lee, Vargo and Seville (2013) suggest rewarding staff for sharing and reporting both good and bad news about the organisation including early warning signs.

Trial-and-error experimentation entails risk of failure, including catastrophic failure (Bain 1999) and it may not be easy to reverse decisions. According to McKenzie (2014), managers in many organisations use a logical incrementalism approach to decision-making as suggested by Quinn (1978). Often, the risk of failure is exacerbated due to the shortage of time, resources and information available to make a full analysis of the various

possible actions and their consequences (Quinn 1978). In a study of 10 major companies, Quinn (1978) observed that successful senior managers dealt with disruptive events by taking small, tentative, incremental steps – often vague in nature or delayed so as to encourage contribution by lower level staff – and subjecting them to a review later. This process of 'logical incrementalism', which still appears to be valid almost four decades later, allowed options to remain open and enabled internal and external stakeholders to test assumptions and to learn and adapt from each other's responses (Quinn 1978, p. 9). Palmberg (2009) suggests a similar approach to dealing with complex situations by starting with small simple experiments, reflecting on their effectiveness and discarding those that don't work. The solution emerges by linking the experiments that lead to the desired outcomes – a process that Palmberg (2009, p.487) refers to as 'chunking'. Weick (1984) too recommends focussing on small wins, or in other words, concrete outcomes of relatively moderate importance, that lead to a larger solution. As Weick (1984) explains, focussing on small scale wins is important because if a problem is defined in very large and difficult terms, people may be overwhelmed by the problem's scale and not do anything about it. Garvin (1993) further observes that organisations who are successful in learning use experimentation to gain incremental knowledge by establishing a continuous improvement system.

Sagan (1994), Lagadec (1997), Ritchie (2004) and Fischbacher-Smith (2010) recommend learning through simulations and exercises. Simulations, exercises and 'what if' scenarios are useful to all organisations, and not just those managing hazardous technologies because, as Kerr (2016) and Parsons (2010) point out, organisations can learn from the experiences of other organisations. In addition, by participating in such exercises, staff can practice established response and recovery arrangements (Parsons 2010), validate

existing plans (Lee, Vargo & Seville 2013), and test assumptions about coping with emerging threats (Fischbacher-Smith 2010).

Pollard and Hotho (2006) highlight the benefits of scenario planning in formulating corporate strategy in a turbulent, complex and uncertain environment. Pollard and Hotho (2006) explain that scenario planning involves developing innovative but plausible scenarios together with designing strategic measures for dealing with these. Scenario planning enables managers to consider alternative futures instead of simply focussing on 'what has been' and 'what works now' (Pollard & Hotho 2006, p. 727). The preceding discussion focussed on the development of learning capabilities within organisations to cope with emergent change. The next section discusses how organisations may develop capabilities to enhance their awareness of the situation.

3.4 Awareness

McManus (2008, p. 9) draws attention to the importance of acquiring, interpreting and utilising information by stating that organisations who successfully learn to cope with unfolding situations are those that are proficient in:

- Sensing the change in the environment, both internally and externally
- Acquiring information and make[sic] sure it is disseminated to where it can be processed and acted upon
- Interpreting the information and formulate[sic] correct or appropriate conclusions.

The challenge for organisations is to anticipate threats and opportunities before they arrive and to recognise them if they actually arrive (Burnard & Bhamra 2011; Friedman 2005; Leonard & Howitt 2012; Madni & Jackson 2009). The ability to anticipate allows organisations to recognise a threat or opportunity in advance so that appropriate action may be taken (Uhl-Bien, Marion & McKelvey 2007). Such action, based upon expectations of how the environment is expected to change, must be taken in the present

so that organisations either avoid disruptions, or achieve desirable outcomes in the future (Madni & Jackson 2009). Hence, anticipation requires predictive capability (Madni & Jackson 2009) and is precautionary in nature (Hollnagel 2014). Therefore, it can be concluded that the purpose of developing capabilities for anticipation is to reduce the amount of surprises that organisations may face. Hollnagel (2014) for example, provides three reasons why organisations need anticipatory capabilities:

- Anticipation enables organisations to formulate new types of responses over and above lessons learnt from the past.
- Anticipation enables organisations to focus their attention on what to look for as they monitor their environment for threats and opportunities.
- Anticipation enables organisations to be proactive rather than reactive to changing circumstances.

According to Friedman (2005) and Weick and Sutcliffe (2008), a challenging aspect of anticipation is that people filter information so that they only see what they want to see. As Wheatley (2008) explains further, people interpret events based upon their own individual experiences. This means that, for example, two different people may have two different versions of the same event (Wheatley 2008). Another challenge to anticipation results from too much information (Friedman 2005; Pearson & Mitroff 1993), or too little information (Fischbacher-Smith 2010; Lagadec 1997; McDaniel 2007; Wang 2011) being available for decision-making. To overcome these challenges, suggestions include improving sense-making (Gephart 2004; McDaniel 2007; Perrow 1984; Weick 2010) and situational awareness (Endsley 1995; Leonard & Howitt 2012; McManus 2008; Stephenson 2010) within organisations.

Gephart (2004, p. 23) defines sense-making as 'the process of reflecting on experience and interpreting the meaning of events'. According to Gephart (2004) sense-making plays a fundamental role in how people understand, and manage, the often unknown and unstated risks and dangers that are inherent in hazardous technologies. For example, Perrow (1984) illustrates how organisations use documented risk assessment procedures to legitimise the adoption of hazardous technologies. In the words of Weick (2010, p. 549), when people face ambiguity, they 'search for meaning, settle for plausibility, and move on'. This may mean that sometimes simple plausible explanations may mask the build up of bigger problems (Weick 2010). In addition, often decision-makers do nothing because they wait for undeniable evidence (Fischbacher-Smith 2010; Lagadec 1997; Ritchie 2004).

According to Endsley (1995) the concept of situational awareness is widely applied in operational situations where operators have to use large amounts of information, for example, pilots flying aircraft. McManus (2008), Stephenson (2010) and Leonard and Howitt (2012) apply the notion of situational awareness to organisations in the context of coping with crises and disasters. Endsley (1995, p. 36) notes that despite there being many definitions of situational awareness, fundamentally they all point to 'knowing what is going on'. In novel situations however, it may be difficult for people to maintain situational awareness because, as Leonard and Howitt (2012) explain, unlike routine emergencies where trained people know which key facts to monitor, in unprecedented situations it is difficult to identify which data to monitor. Weick, (2010) further elaborates that awareness is a distinct concept to alertness. Weick (2010, p. 545) states that 'alertness is an attempt to notice something that is out of place, unusual or unexpected' whereas 'awareness is an effort to generate conjectures about what that anomaly might mean'. Weick's (2010) explanation of awareness together with the emphasis on perception and

comprehension in the following definition by Endsley, (1995, p. 36) suggests that organisational capabilities for sense-making and situational awareness may be quite similar:

> Situation awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.

Seville et al. (2015) suggest that organisations should continually test their assumptions about risks in case they are wrong. Emphasis on unquestioning adherence to plans and risk assessment documents may leave people in organisations ill-prepared to notice changing conditions (Gephart 2004). Lee et al. (2013) recommend that staff should be rewarded for quickly reporting early warning signals to senior managers. To assist people in recognising warning signs, Simola (2005) suggests that organisations should clearly specify warning thresholds for disruptions and staff should report any detected signals to the decision-makers. Sheffi and Rice (2005) suggest that technology may also be helpful in alerting people to disruptions, for example, the use of shipment visibility systems by logistics companies to track and trace shipments.

It may not be easy for people to become aware of change in their environment because, as McDaniel (2007, p. 29) explains, people often assume that 'because one is at the centre of things one must know what is happening and if they do not know then it must not be happening'. To address this problem, Hopkin, (2014), Kerr (2016) and Seville, Van Opstal and Vargo (2015) recommend that staff should be encouraged to network with external stakeholders such as customers, industry experts and even competitors so that their awareness is enhanced and signs of changing environment are picked up early. Garvin (1993) recommends two other strategies for increasing awareness by utilising

external networks: benchmarking to uncover industry practices; and, collecting feedback from customers.

In order to increase awareness of potential problems that may affect organisational performance, Lagadec (1997) and Seville, Van Opstal and Vargo (2015) recommend breaking down organisational silos to increase collaboration and the flow of information within the organisation. Lee, Vargo and Seville (2013) suggest that breaking down barriers to communication may also help to reduce social, cultural and behavioural barriers within organisations. Communication flow within the organisation should include internal debates that are based on facts and situations rather than opinions (Dahms 2010). Open communication channels help to transfer knowledge within an organisation (Friedman 2005; Garvin 1993; Hopkin 2014; Jansen, Cammock & Conner 2011). Garvin (1993), McManus (2008) and Wang (2011) recommend that staff should be rotated to work in different areas and roles so that expert knowledge spreads within the organisation and silos are broken down. In addition, Jansen, Cammock and Conner (2011) and Seville, Van Opstal and Vargo (2015) suggest mentoring programs for new staff to foster personal connections. Such actions help to develop social capital, described by Leana and van Buren (1999, p. 538, 539) as 'an asset embedded in relationships – of individuals, communities, networks or societies'. An advantage of maintaining social capital is that organisations may be able to call upon their networks for advice and assistance if needed (Sutcliffe & Vogus 2003).

The preceding recommendations in the literature emphasise the value of people-to-people interactions, both within organisations and between organisations and their external stakeholders, in order to develop organisational capabilities for awareness. The following section discusses recommendations from the literature to develop organisational capabilities for innovation.

3.5 Innovativeness

There is a widely held belief that in order to successfully cope with novel situations, organisations require innovative behaviour, improvisation and creativity (see, for example, Lalonde 2011; McDaniel 2007; McKenzie 2014; Ryan 2009; Stewart & O'Donnell 2007; Witmer & Mellinger 2016). Improvisation means 'the ability to devise a solution when faced with a problem, while lacking some of the tools or all of the necessary information' (Lalonde 2011, p. 459). Organisations need to be resourceful, that is, 'capable of identifying efficiently the issues or problems, establishing priorities and mobilising resources' quickly (Lalonde 2011, p. 459).

The justification for the need for innovation arises from the same reasons that were articulated earlier in this chapter regarding the need for learning and awareness – organisations cannot necessarily rely on pre-existing plans and procedures to cope with dynamically unfolding unexpected situations (Jansen, Cammock & Conner 2011; Lagadec 1997). Actual conditions seldom match the intended conditions (Hollnagel 2014) and standard operating procedures may be of little use, especially when chaos erupts and the situation go out of control (Wheatley 2008). Furthermore, when fresh opportunities emerge, organisations may require new ways of thinking and conducting business to exploit them for their benefit (Välikangas 2010).

One logical way of increasing organisational capacity for innovation is by employing staff who possess critical thinking skills and can apply them creatively to find novel solutions to problems. Findings of an Australian job advertisement survey show that since 2012, the demand by employers for employee skills in critical thinking has increased by 158 percent and for creativity by 65 percent (Morton 2016). However, the challenge for organisations is to first create an environment that enables innovation to occur and

second, to channel the innovative actions of people towards the achievement of the desired organisational performance outcomes.

For innovation to occur, organisations need to create an environment where staff are motivated and empowered to take the initiative, but some scholars maintain that conventional hierarchical organisational structures and management styles may inhibit rather than facilitate innovation (see, for example, Dahms 2010; McDaniel 2007; Palmberg 2009; Pollard & Hotho 2006; Watts 2014; Wheatley 2008). Pollard and Hotho (2006) suggest that rational analysis and thinking, rather than innovation, has a much greater influence on how many organisations formulate, implement and evaluate strategies. As per Hollnagel (2014, p. 226) many organisations are managed under the assumption that:

> systems work because they are well designed and scrupulously maintained, because procedures are complete and correct, because designers can foresee and anticipate even minor contingencies, and because people behave as they are expected to – and more importantly as they have been taught or trained to do.

The approach outlined by Hollnagel (2014) is symptomatic of a command and control type management thinking (Raye 2014; Zokaei, Seddon & O'Donovan 2011). Command and control thinking is characterised by a top-down hierarchical perspective, functional specialisation and being remote from operational decision-making (Watts 2014). There is a strict task hierarchy and the usual way of working is through instructions and orders passed down from managers to operational staff (Bhaskar, Cahoon & Brooks 2014). Standard operating procedures are the norm and any deviation from established rules and procedures is discouraged and even penalised (Bhaskar, Cahoon & Brooks 2014). The command and control thinking treats organisations as machines and seeks efficiency, stability, control and obedience (Wheatley 2008). This results in disengaged and unmotivated staff who behave like robots and simply wait for instructions (Watts 2014;

Wheatley 2008). Raye (2014) argues that command and control management often creates information silos within organisations because employees tend to hoard information as power for internal advancement up the organisational hierarchy. Hence, instead of uniting people towards a common purpose, command and control management tends to generate resentment and division (Raye 2014).

Even though 21st century organisations face a complex dynamic environment as detailed in Chapter One, Palmberg (2009, p. 484) claims that the principles of conventional management are still largely based upon 'stability as the objective, analysis by reduction to parts, and cause and effect mechanisms between the parts'. In contrast to the command and control approach, some scholars suggest that viewing organisations as systems similar to CAS found in the natural world may help develop organisational capacity to cope with dynamically changing situations that are characterised by uncertainty (see, for example, Dahms 2010; Espinosa & Porter 2011; Hammer, Edwards & Tapinos 2012; Jansen, Cammock & Conner 2011; McDaniel 2007; McKenzie 2014; Palmberg 2009; Uhl-Bien, Marion & McKelvey 2007; Wheatley 2008). As discussed in Chapter Two, CAS possess two characteristics that are important to the management of organisations – self organisation and emergence (Bovaird 2008; De Wolf & Holvoet 2005; Espinosa & Porter 2011; Jansen, Cammock & Conner 2011; McDaniel 2007; McKenzie 2014; Palmberg 2009; Schneider & Somers 2006). Under the CAS framework, the challenge for managers of organisations is how to influence self-organisation so that the emergent phenomenon leads to desired performance outcomes. In other words, the problem becomes one of creating order from chaos (Jansen, Cammock & Conner 2011; Wheatley 2008).

Unlike ecological systems, organisations are intentional systems populated by humans who can anticipate and take proactive action (Hollnagel 2014). Some scholars suggest

that leadership can play a major role in shaping self-organisation and hence emergence in organisations (see, for example, Jansen, Cammock & Conner 2011; McKenzie 2014; Seville, Van Opstal & Vargo 2015). Order emerges in chaos due to self-organisation, without command and control (Wheatley 2008). For self-organisation to occur, people need to share a common interest or passion so they can figure out creative solutions (Wheatley 2008). McKenzie (2014) recommends that rather than a centralised command and control approach, it is best to create a common vision and allow for a diversity of approaches to reach the destination. By providing a vision, rather than detailed top down instructions which inhibit individual freedom, senior managers can create attractors that encourage people to utilise their capabilities (Palmberg 2009). The leadership role therefore becomes one of facilitation and empowerment of employees (McKenzie 2014).

For self-organisation to have a positive impact, people in organisations should be connected through shared purpose and values (Raye 2014). For best outcomes, there should be a balance between individuals' perspectives and the shared vision (Raye 2014). People's ability to see the big picture and organisational dynamics is improved as their accessibility to information increases (Raye 2014). Espinosa and Porter (2011) recommend that managers should encourage bottom-up, top-down and internal-external communications and interactions. The interplay between bottom-up and top-down behaviours shapes emergence (Bovaird 2008). McKenzie (2014) recommends that senior managers should ensure that they are accessible and that they embody organisational values in their behaviour and actions.

Although senior managers set visions, they are unlikely to be achieved through innovation unless people are allowed to experiment (Espinosa & Porter 2011; McKenzie 2014). Experimentation for innovation carries similar risks to organisations as were discussed previously with reference to experimentation for learning. Furthermore, Palmerg (2009)

suggests that managers need to create an environment of tension and instability, for example through diversity, for innovation to take place. Palmberg's (2009) suggestion matches the creative destruction concept that was discussed with reference to the adaptive cycle heuristic in Chapter Two. Opportunities for innovation occur during the back loop of an adaptive cycle which is also a period of chaotic change and reorganisation (Holling 2001). The panarchy heuristic discussed in Chapter Two suggests that innovation best takes place at smaller scales within an organisation to avoid the risk of a system wide failure. The idea of small-scale innovation is therefore similar to logical incrementalism (Quinn 1978) and chunking (Palmberg 2009) discussed previously.

Garvin (1993) recommends that organisations should have an incentive system that favours risk taking so that the benefits of experimentation are realised. The dilemma is the trade-off between control over experiments and stifling creativity without penalising employees for failed initiatives (Garvin 1993). Garvin (1993) provides the example of an organisation where the outcomes of experiments are not included in performance evaluation of managers, but managers are required to get prior approval from superiors before undertaking expensive, high impact experiments. This suggests that it is important for people to know the limits of their roles and responsibilities, and how their job links to organisational objectives (Lee, Vargo & Seville 2013).

In summary, the prescriptions from the literature appear to suggest that awareness, learning and innovativeness are organisational capabilities that may contribute to the avoidance of disruptions. If a disruption was to occur however, reliance on capabilities that assist in recovery may be necessary as discussed in the next section.

3.6 Robustness

According to Mamouni Limnios et al. (2014, p. 105) the notion of robustness arises from the engineering discipline where it refers to the ability to 'absorb disturbances and consequently return to equilibrium…recognising a single stable state'. Martin-Breen and Anderies (2011, p. 14) equate robustness with resilience over a short time scale and state that robustness refers to 'the capacity of a system to continue to function given external shocks' and this implies that the system 'is studied over a short (small time scale) period during which the fundamental properties of the system and exogenous shocks do not change'. Accordingly, in this thesis, robustness refers to an organisation withstanding the impact of a disruption either through quick recovery or through absorption of the impact without lasting change.

In organisational studies, recovery from disruptions has been widely studied in the field of crisis management. Simola (2005) notes that modern crisis management literature has emerged since the high-profile crisis experienced by the company Johnson & Johnson in 1982 due to contamination in one of its products which resulted in the deaths of seven people in the US. The impacts of crises can be high even though the probability of crises affecting organisations is low (Pearson & Clair 1998; Smith & Fischbacher 2009). Crises can cause severe financial damage to organisations (Devlin 2007; Shrivastava et al. 1988; Smith 2006) and threaten their strategic goals (Harrald 1998) and viability (Ashby & Diacon 2000; Pearson & Clair 1998). Human life as well as natural and social environments may be damaged (Shrivastava et al. 1988), resulting in greater media scrutiny and government intervention (Devlin 2007). In addition, the public image and reputation of the affected organisation may be jeopardised (Devlin 2007; Smith 2006). Crises put a great amount of time pressure on decision-makers (Harrald 1998; Pearson &

Clair 1998) and 'confound the abilities of those who try to manage them' (Smith 2006, p. 70). Not all outcomes of crises are negative however, as Faulkner (2001) points out that crises can stimulate innovation and recognition of new markets. Furthermore, a firm may be able to use a crisis as trigger for inducing rapid organisational change and learning while the manner and effectiveness of its response to the crisis may benefit its image and position in the market (Ashby & Diacon 2000). Faulkner's (2001) and Ashby and Deacon's (2000) view echoes that of Holling (2001) who postulated that the reorganisation phase of the adaptive cycle following crises provides CAS with opportunities for renewal.

Mitroff, Alpaslan and Green (2004) note that there is no widely accepted definition of crisis in literature. However, the following definition of crisis by Pearson and Clair (1998, p.60) is frequently cited by scholars to describe a crisis:

> An organizational crisis is a low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect and means of resolution, as well as by a belief that decisions must be made swiftly.

Although Pearson and Clair (1998) characterise crises as low-probability events, Seville (2017) quotes two studies which suggest that crises may not be rare. Seville (2017) mentions a study in the late 1990s of the largest 1000 companies in the world which found that more than 40 percent of the companies had experienced a crisis in the preceding five years. A study of businesses in Auckland, New Zealand carried out in 2011 revealed 41 percent of the organisations had experienced crises in the preceding five years (Seville 2017).

According to Pearson and Clair (1998) effective crisis management efforts should lead to operations being sustained or resumed. Prescriptions for effective crisis response include: written crisis management plans with clearly articulated roles and responsibilities of

responders (Hopkin 2014; Simola 2005); effective relationship and communication with stakeholders (Hopkin 2014; Simola 2005); training, exercises and scenario planning (Lagadec 1997; Pollard & Hotho 2006); and flexible bureaucratic structures (Lalonde 2011). The related concept of business continuity management (BCM) is a relatively new concept that has its roots in disaster recovery planning which initially focussed on information technology systems (Elliott, Swartz & Herbane 2010; Kelly & McMullan 2012). In practice, the aim of BCM is to ensure that in the event of a major disruption, essential business services are resumed and delivered in a timely manner. The primary output of the BCM planning process is a business continuity plan (Momani 2010) that is designed with three objectives: reducing risks; reducing the impact of a disruptive event; and reducing the time it takes to restore operations to business as usual state (Cerullo & Cerullo 2004).

Although the CAS framework does not assume a state of equilibrium, two prescriptions for resilience from CAS thinking – modularity and diversity – may influence the impact that a disruption may have on an organisation. Walker and Salt (2006, p. 121) define modularity as the 'manner in which the components that make up a system are linked'. For organisations this may mean how markets, facilities, organisational units, people and technology are linked to one another. In highly connected systems, shocks from disruptions can travel rapidly through the whole system whereas in loosely connected systems should a module fail, the system as a whole may survive (Walker & Salt 2006). Modularity therefore is similar to Perrow's (1984) notion of coupling.

Diversity refers to variety in the system (Walker & Salt 2006). For organisations, this may mean the number and types of markets, facilities, organisational units, people and technology that make up the organisational system. Variety provides flexibility in

response which Walker and Salt (2006, p. 69) term as 'response diversity'. For organisations, response diversity implies greater choices in how they meet challenges and opportunities created by threats and disruptions.

The resilience capabilities discussed in the preceding sections as learning, awareness, innovativeness and robustness are not discrete capabilities. There is likely a complex relationship between them. For example, Garvin (1993) notes that organisational learning occurs when people in organisations develop an awareness of new ideas and knowledge. This leads to a change in employee behaviour which results in improved organisational performance (Garvin 1993; Stewart & O'Donnell 2007). Hence, in Garvin's (1993) example, the organisational capabilities for learning, awareness and innovation are interrelated. Taking another example, scenario planning may contribute to learning within an organisation. The knowledge gained from such an exercise may contribute to an organisation's robustness by being utilised in a crisis situation. However, conceptualising resilience capabilities in terms of learning, awareness, innovativeness and robustness provides a useful framework to manage the conceptualisation and operationalisation of the multifaceted capabilities and activities that contribute to organisational resilience.

3.7 Conceptualising organisational resilience capabilities

Table 3-1 shows the organisational capabilities, their dimensions and indicators as conceptualised in this thesis through the review and synthesis of literature in this chapter. Given the paucity of literature pertaining to shipping companies' resilience, this synthesis provides a framework to evaluate the activities occurring in shipping companies that may contribute to resilience.

Based upon the synthesis of the literature, learning capability is conceptualised in this thesis as consisting of two dimensions – learning culture and knowledge creation processes (see Table 3-1). Learning culture is defined as culture that supports creation of new knowledge to solve problems and exploit opportunities. The indicators of learning culture are freedom of expression (Friedman 2005; Garvin, Edmondson & Gino 2008; Jansen, Cammock & Conner 2011; Leonard & Howitt 2012; McDaniel 2007; McKenzie 2014; Sutcliffe & Vogus 2003) and learning capability development (Gephart 2004; Lee, Vargo & Seville 2013; Seville, Van Opstal & Vargo 2015). Knowledge creation processes are defined as processes that facilitate creation of new knowledge. The indicators of knowledge creation processes are scenario simulations (Fischbacher-Smith 2010; Pollard & Hotho 2006; Sagan 1994), learning from successes and failures (Garvin 1993; Hopkin 2014), and decision-making training (McKenzie 2014; Palmberg 2009).

Awareness is conceptualised in this thesis as consisting of two dimensions – social capital and networking (see Table 3-1). Social capital is defined as the network of relationships among people within an organisation that facilitates awareness of how the organisation functions. The indicators of social capital are interactions and collaboration among employees (Black & La Venture 2017; Dahms 2010; Friedman 2005; Lee, Vargo & Seville 2013; Seville, Van Opstal & Vargo 2015; Simola 2005; Wang 2011) and employee knowledge of organisation (Garvin 1993; Seville, Van Opstal & Vargo 2015; Simola 2005). Networking is defined as interactions between people in the organisation and external stakeholders. The indicators of networking are business environment awareness (Seville, Van Opstal & Vargo 2015) and stakeholders' expectations awareness (Garvin 1993).

Innovativeness is conceptualised in this thesis as consisting of two dimensions – staff empowerment and supportive leadership (see Table 3-1). Staff empowerment means that

staff have the authority to use initiative and creativity to solve problems and exploit opportunities. The indicators of staff empowerment are delegation (Jansen, Cammock & Conner 2011), and staff competency development. Supportive leadership is defined as leadership that facilitates emergence towards desired outcomes. The indicators of supportive leadership are shared values and purpose (McKenzie 2014; Raye 2014; Wheatley 2008), and support for innovation (McDaniel 2007; Seville, Van Opstal & Vargo 2015).

Robustness is conceptualised in this thesis as consisting of two dimensions – recovery planning and modularity and response diversity (see Table 3-1). Recovery planning is defined as planning for recovery after disruption. The indicators of recovery planning are provision for crisis management and business continuity plans (Hopkin 2014; Lee, Vargo & Seville 2013; Simola 2005) and training and practice in recovery response (Lee, Vargo & Seville 2013; Pollard & Hotho 2006). Modularity and response diversity is defined as the interconnectedness and variety in the organisational system. The indicators for modularity and response diversity are the provision of back-up resources and business diversity.

Table 3-1: Resilience capabilities, dimensions and indicators

Capability	Dimension	Definition of dimension	Indicator	Description of indicator
Awareness	Social capital	Network of relationships among people within an organisation which facilitates awareness of how an organisation functions	Interaction and collaboration among employees	Interactions and collaborations take place among employees (Espinosa & Porter 2011). Incentives are provided for reporting threats, opportunities and disruptions (Garvin 1993). Employees are mentored (Jansen, Cammock & Conner 2011; Seville, Van Opstal & Vargo 2015).
			Employee knowledge of organisation	Employees understand their roles and responsibilities (Lee, Vargo & Seville 2013). Employees are aware of organisation's performance (Seville 2017).
	Networking	Interactions between people in the organisation and external stakeholders	Business environment awareness	Information sources are available. Employees interact with stakeholders (Seville, Van Opstal & Vargo 2015; Kerr 2016). Organisation is benchmarked against other companies (Garvin 1993).
			Stakeholders' expectations awareness	Feedback is obtained from stakeholders (Garvin 1993).
Learning	Learning culture	Culture that supports creation of new knowledge to solve problems and exploit opportunities.	Freedom of expression	Employees feel safe to talk about problems at work (Garvin, Edmondson & Gino 2008; Hopkin 2014; McDaniel 2007; McKenzie 2014) Diversity of opinion is encouraged (Darnhofer et al. 2010; Leonard & Howitt 2012; Vogus & Sutcliffe 2003). Employees can exchange information freely within the company.
			Learning capability development	Planning assumptions are questioned (Seville et al. 2015). Learning skills are included in staff development activities and in staff selection criteria. Employees are rewarded for sharing new knowledge. Employees can access lessons from past failures

	Knowledge creation processes	Processes that create new knowledge	Scenario simulations	Employees participate in exercises involving 'what if' scenarios (Fischbacher-Smith 2010; Lee, Vargo & Seville 2013; Parsons 2010).
			Learning from failures	Processes exist for systematic review of past failures and continuous improvement (Garvin 1993; Hopkin 2014; Ritchie 2004; Sheffi & Rice 2005).
			Decision-making training	Managers are trained in decision-making techniques under uncertainty (Palmberg 2009; Quinn 1978; Weick 1984).
Innovativeness	Staff empowerment	Staff are empowered to use initiative and creativity to solve problems and exploit opportunities	Delegation	Decision-making is decentralised. Staff contribute to strategic planning (Kamalahmadi & Parast 2016).
			Staff competency development	Staff development activities target problem solving skills. Problem-solving and creativity skills are essential criteria in staff recruitment.
	Supportive leadership	Leadership that facilitates emergence towards desired outcomes	Shared purpose and values	Values and purpose are shared across the organisation at all hierarchical levels (Raye 2014; Wheatley 2008). Managers embody organisational values in practice (McKenzie 2014).
			Support for innovation	Rules and procedures allow flexibility (Lalonde 2011). Innovation is rewarded. Managers are accessible to staff (McKenzie 2014).
Robustness	Recovery planning	Planning for recovery after disruption	Plans for recovery	Plans exist for crisis management and business continuity (Simola 2005; Hopkin 2014).
			Training and practice	Crisis management and business continuity training is provided to employees. Crisis management and business continuity exercises are practised (Sagan 1994; Pollard & Hotho 2006).
	Modularity and response diversity	Interconnectedness and variety in the organisational system	Back-ups	Critical back-up and substitute resources, people and technology are available (Zsidisin & Wagner 2010). Supportive relationships are maintained with stakeholders

				(Sutcliffe & Vogus 2003; Christopher & Peck 2004; Hopkin 2014).
			Business diversity	The extent to which organisation's business is diversified.

3.8 Summary

This chapter has identified the organisational capabilities that contribute to resilience. The capabilities identified are learning capability, awareness, innovativeness and robustness. The organisational activities that contribute to the development of capabilities have also been identified. Learning capability, awareness and innovativeness are capabilities that are independent of time and space. Robustness capability is utilised to withstand disruptions over a short time scale. The dimensions and indicators of resilience capabilities have been conceptualised to assist in the development of a conceptual framework in the next chapter on research design and methodology.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

This chapter explains the research design and methodology utilised for collecting and analysing data to answer the research questions. Starting with the conceptual framework underpinning this exploratory study, the chapter explains how the requirement for obtaining both qualitative and quantitative data leads to a pragmatic approach utilising both qualitative and quantitative techniques. This mixed methods approach guides the development of a questionnaire instrument for interviewing senior managers of shipping companies in Australia. The chapter further explains the basis on which a telephone interview was chosen as the most suitable method of data collection, in addition to the administration of the survey, and the error control strategies used to minimise survey error.

4.2 Conceptual framework

A conceptual framework provides a foundation for research design and methodology by illustrating the main concepts and their presumed relationships with each other (Punch 2005). The conceptual framework for this study was developed by reviewing the literature pertaining to resilience and identifying the organisational capabilities contributing towards organisational resilience. As discussed in Chapters Two and Three, when organisations are faced with unforeseen, unfamiliar and unexpected disruptive situations that threaten their viability, they may be able to avoid failure and maintain functionality in one of two ways. When faced with threats of disruptions, organisations may be able to avoid actual disruption by utilising their capabilities for awareness, learning and innovation to adapt or transform themselves to suit changing circumstances. If, however, a disruption was to occur, organisations may be able to maintain functionality by utilising organisational capabilities that contribute towards recovery, damage control and

flexibility of response, that is, robustness. A resilient organisation is able to maintain functionality either by avoiding a disruption or by withstanding a disruption should it occur. Figure 4.1 illustrates this conceptual framework.

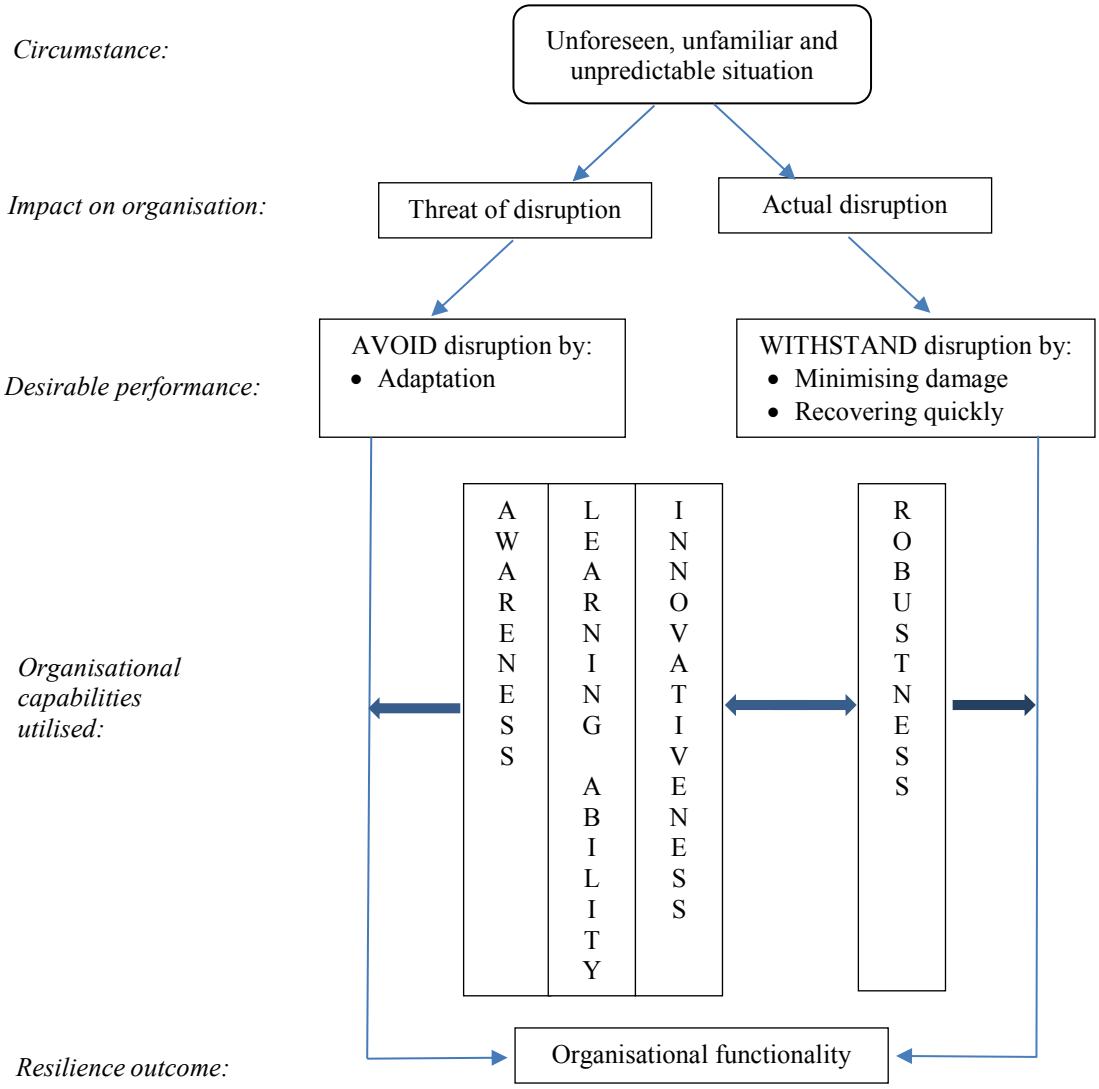


Figure 4-1: Conceptual framework

The conceptual framework outlined in Figure 4-1 gives direction to the design of this study by highlighting the broad areas which require empirical investigation to answer the research questions.

4.3 Research design

A research design should consist of a clear description of the research question and the overall plans for the collection, measurement and analysis of data necessary to answer that question (Gray 2013; Singleton & Straits 2010). As detailed in Chapter One, this study investigates the following primary research question (PRQ):

PRQ: How can shipping companies develop organisational resilience capabilities?

PRQ is addressed by posing three secondary research questions (SRQs):

SRQ1: Which organisational capabilities contribute to the resilience of shipping companies?

SRQ2: How do senior managers of shipping companies develop their organisation's resilience capabilities?

SRQ3: How is organisational resilience characterised by senior managers of shipping companies?

Punch (2005) and Teddlie and Tashakkori (2009) recommend that the selection of the research method should follow the research questions so that the two match each other as closely as possible. Under this approach, the choice of research design, sampling and data analysis techniques is driven by the research questions (Clark & Badiee 2010). This approach fits the pragmatic perspective where 'designs and methods are selected based on "what works" for answering the stated research questions' (Clark & Badiee 2010, p. 279). Different methods may be needed to answer different questions in a study (Punch 2005). For this study, the answers to SRQs require the collection of both qualitative and

quantitative data which influences the research design and methodology. This is explained in the following paragraphs.

The requirement for qualitative data arises primarily due to the exploratory nature of this research. The study collects data about the capabilities utilised by shipping companies to withstand disruptions as well as those utilised to avoid disruptions when faced with threats of disruptions. Such data can be provided by witnesses to disruptions and threats. As the unit of analysis is the shipping company, senior managers such as managing directors, chief executive officers and other members of the executive management team are considered to be best placed to observe and report on situations that affect the organisation as a whole. As Kumar (2014) explains, the quality of primary data collected depends on the knowledge and capacity of respondents to answer the questions. By occupying positions at the top tier of the organisational hierarchy, senior managers are likely to have knowledge and information about the strengths, weaknesses, opportunities and threats to their company. In addition, senior managers have a direct role in shaping organisational policies and practices. Through investigation of senior managers' descriptions of disruptions, threats of disruptions, organisational responses, precautionary measures, anticipatory actions, and lessons learnt, this study investigates the 'impressions of witnesses' that 'are constructions of what they thought happened' (Sarantakos 2013, p. 38). Furthermore, this study also investigates the subjective meaning of resilience by senior managers. Hence this study is guided by a constructivist ontology and an interpretivist epistemology both of which are characteristics of qualitative research (Sarantakos 2013).

In Chapter Two, organisational resilience was defined with reference to an organisation's ability to maintain functionality in a disruptive environment. The emphasis on maintaining functionality logically leads to collecting data that describes how individual

companies cope with disruptions, and threats of disruptions, that may affect their viability. Due to the uniqueness of individual shipping companies and their circumstances, plus the lack of publicity by companies of their own failures, such information is not readily available from secondary sources. Hence, when asking senior managers about their experiences of actual disruptions and threats, descriptive open-ended questions rather than closed-ended questions are more appropriate because the range of responses are not known beforehand (Fink 2003; Zikmund et al. 2013). Descriptive open-ended questions have the potential to elicit more detailed and higher quality responses (Dillman, Smyth & Christian 2009; Gray 2013; Walter 2013) in exploratory studies.

Answering descriptive open-ended questions does however require a significant investment of time, mental energy and physical energy on the part of respondents (Dillman, Smyth & Christian 2009). This is an important consideration because senior managers tend to be busy people with little free time (Bourque & Fielder 2003). Dillman (2009) recommends using descriptive open-ended questions sparingly so that respondents are motivated to answer them well. If too many descriptive open-ended questions are asked, respondents may provide only perfunctory answers (Dillman, Smyth & Christian 2009). The choice of descriptive open-ended questions becomes even less attractive when asking senior managers to identify the type and extent of activities occurring in their company that may contribute towards organisational capabilities of awareness, learning ability, innovativeness and robustness. As discussed in Chapter Two, there is no shared understanding of what organisational resilience means in literature and it is unclear to what extent senior managers share the same. There exists the possibility that when asked about organisational capabilities that contribute towards resilience - learning for example - senior managers may reply from a perspective or frame of reference (Singleton & Straits

2010) that is different from that required for managing disruptions. This may lead to information that is irrelevant to the study (Babbie 2014). The frame of reference problem may be solved by following Singleton's (2010, p. 338) advice that:

> compared with a general question, a comprehensive series of specific questions better conveys to the respondent the information sought by the researcher, as well as facilitating information retrieval by triggering different memory associations.

A synthesis of literature in Chapter Three identified dimensions of organisational capabilities of awareness, learning ability, innovativeness and robustness and the indicators of those dimensions. These indicators provide a ready source of specific questions or statements about the activities practiced by organisations that may contribute to such capabilities. Hence, brief statements requiring senior managers to indicate their level of agreement by using fixed response alternatives are also used in this study to create the same frame of reference for all respondents (Singleton & Straits 2010), reduce the cost of participation for respondents (Dillman, Smyth & Christian 2009), and make it easier to manage data (Babbie 2014).

In summary, this study collects mostly qualitative data when respondents are asked to describe their experiences in coping with disruptions and threats, or to describe their understanding of the term 'resilience'. Mostly quantitative data is collected when respondents are asked to indicate their level of agreement to statements about activities occurring in their company with respect to awareness, learning, innovation, and robustness. Hence this study employs both qualitative and quantitative approaches to study resilience of shipping companies. Table 4-1 maps the three SRQs against the type of data collected to answer them.

Table 4-1: Types of data collected

SRQ	Type of data collected
SRQ1: *Which organisational capabilities contribute to the resilience of shipping companies?*	qualitative
SRQ2: *How do senior managers of shipping companies develop their organisation's resilience capabilities?*	mostly quantitative some qualitative
SRQ3: *How is organisational resilience characterised by senior managers of shipping companies?*	mostly qualitative some quantitative

The integration of qualitative and quantitative approaches is described as a mixed methods research approach (Creswell & Plano Clark 2007; Gray 2013; Kumar 2014; Maxwell, Chmiel & Rogers 2015; Teddlie & Tashakkori 2009). In mixed methods studies, the design is dictated by research questions (Clark & Badiee 2010). Research questions are answered with both qualitative and quantitative information, and data analysis requires the integration or mixing of both statistical as well as thematic analytic techniques (Maxwell, Chmiel & Rogers 2015; Teddlie & Tashakkori 2009). A mixed methods study is appropriate if the combination of quantitative and qualitative approaches provides a better understanding of the phenomenon being studied than either a quantitative or qualitative approach alone (Molina-Azorin & Cameron 2015).

The mixed methods approach is associated with the philosophical worldview of pragmatism (Clark & Badiee 2010; Creswell & Plano Clark 2007; Gray 2013; Teddlie & Tashakkori 2009). Teddlie and Tashakkori (2009, p. 7) define pragmatism as 'a deconstructive paradigm that debunks concepts such as "truth" and "reality" and focuses instead on "what works" as the truth regarding the research questions under investigation'. Creswell and Plano Clark (2007, p. 23) further elaborate that the focus of mixed methods research is 'on the consequences of research, on the primary importance

of the question asked rather than the methods, and multiple methods of data collection'. The approach used in this study is to merge qualitative and quantitative data to obtain results by triangulation (Creswell & Plano Clark 2007). According to Creswell and Plano Clark (2007) there are five different design approaches in mixed methods research: concurrent triangulation design, convergence model, data transformation model, validating quantitative data model and multilevel model. The approach used in this study is based upon the concurrent triangulation design. Concurrent triangulation design '*generally* [emphasis added] involves the concurrent, but separate, collection and analysis of quantitative and qualitative data' and merging the results during interpretation (Creswell & Plano Clark 2007, p. 64). For this study, data is collected at the same time, not separately, because gaining access to elites is difficult (Bourque & Fielder 2003; Mikecz 2012) and obtaining all data at the same time is a pragmatic approach.

The use of mixed methods means that more time and work is needed to handle, analyse and process two sets of data (Kumar 2014). A further challenge arises because separate standards for assessing data quality exist for quantitative and qualitative studies (Teddlie & Tashakkori 2009). In quantitative studies, data quality is evaluated in terms of validity and reliability whereas in qualitative studies, data quality is concerned with credibility and dependability (Teddlie & Tashakkori 2009). Despite the challenges, the main benefit of the mixed methods approach is that it helps 'answer questions that cannot be answered by qualitative or quantitative approaches alone' (Creswell & Plano Clark 2007, p. 9).

4.4 Data collection

This study utilises both secondary and primary data to answer the research questions. As shipping is a global industry, the population of shipping companies is dispersed all over

the world. Hence the sampling decision has a major impact on the choice of data collection method used and is therefore discussed first.

4.4.1 Sampling

The choice of sampling techniques available to researchers can be broadly categorised into probability sampling techniques and nonprobability sampling techniques (Babbie 2014; Creswell & Plano Clark 2007; Fink 2003; Gray 2013; Kumar 2014; Singleton & Straits 2010; Teddlie & Tashakkori 2009). As each technique has its own advantages and disadvantages in particular contexts, the guiding principle should be to select units of analysis that address the research questions (Punch 2005; Teddlie & Tashakkori 2009). This study utilises judgement based purposive sampling (Babbie 2014; Kumar 2014; Singleton & Straits 2010) to collect data from shipping companies operating in Australia. The judgement based purposive sampling is a type of nonprobability sampling in which the sample selection is based upon the researcher's judgement about who can provide the best information to answer the research questions (Kumar 2014). The justification for the sampling method utilised in this study is explained as follows.

Australian shipping is a microcosm of international shipping due to the variety of shipping undertaken. As can be seen in the sampling frame in Appendix A, shipping companies operating in Australia utilise container ships, dry bulk carriers, tankers, general cargo ships and other types including passenger and offshore support vessels to provide their services. In terms of number of ships operated, company sizes range from one ship to over 600 ships. Employee numbers range from 12 to 60,000 employees. Out of the 57 companies, 39 are overseas companies who operate in Australia via subsidiaries or branch offices. These overseas companies are headquartered in various countries. The reason for this large and diverse presence is because being an island nation, shipping is an essential

and crucial economic activity in Australia. According to Australia's infrastructure and transport minister Darren Chester, 99 per cent of Australia's merchandise trade is carried by ships making almost 29,000 visits to Australian ports annually (Sexton 2016). Australian ports handle 1.4 billion tonnes of cargo annually (Sexton 2016) and almost 14,000 people are employed in the shipping industry (MIAL 2016). The Australian shipping industry performs the fifth largest shipping task in the world (MIAL 2016). In certain commodities, especially those that form the basis of industrial activity, Australia's shipborne trade is large enough to be of global significance. For example, in 2015 dry bulk carriers transported 4,681 million tonnes of cargo globally including 1,353 million tonnes of iron ore and 1,155 tonnes of coal (INTERCARGO 2016). Iron ore and coal were therefore respectively the largest and second largest types of bulk cargo carried by ships in 2015 (INTERCARGO 2016). In 2014, Australian export of iron ore amounted to 54% of the world market share and export of coal amounted to 31% of the world market share (UNCTAD 2015).

Data available from the website of the Australian Government Department of Foreign Affairs and Trade (DFAT) shows the dominance of minerals, coal, natural gas, crude oil and agricultural items in Australian exports. Hence it is not surprising that Australia has a thriving tramp shipping sector. With respect to liner shipping too, Australia is well served. According to data provided by the liner shipping information service provider Alphaliner (2017) the 15 largest liner shipping operators in the world (consisting of individual shipping companies such as Hapag-Lloyd as well as groups such as CMA CGM Group) together provided 78.8% of the global TEU capacity as on 7 January 2017. An internet search of the websites of these 15 operators carried out on 11 June 2016 showed that all 15 have permanent presence in Australia, either through Australian subsidiaries or through branch offices located in Australia. Moreover, compared to the

global average of less than 16 shipping companies providing liner services per country (UNCTAD 2015), a perusal of the Directory of Maritime and Logistics Services 2015/16 available on the website of the newspaper Lloyd's List Australia (LLA) on 22 July 2016 showed that there were 27 shipping companies providing liner services in Australia (LLA 2016).

Appendix A contains a list of 57 companies that were providing shipping services in Australia on 22 July 2016. Data for the list was obtained as described in subsection 4.4.3. The list shows that the shipping companies servicing Australia operate a diverse range of ships capable of transporting passengers, livestock, containerised cargo, dry bulk cargoes, liquid bulk cargoes, roll on/ roll off cargoes and breakbulk cargoes. Similarly, the list shows the diverse range between companies in the number of ships operated, and the areas of operation of ships. Eighteen out of the 57 companies were headquartered in Australia while the rest were overseas owned. The range and diversity of shipping companies coupled with the presence of 39 overseas companies in the Australian sample points towards a high degree of representativeness of the global population of shipping companies. Thus, although the use of purposive sampling means that study findings are limited in terms of generalisation opportunities (Singleton & Straits 2010), the extent of the representativeness of this sample may yet enable this study to contribute towards understanding how the global population of shipping companies manages organisational resilience. In addition, rich descriptions may assist the transferability of inferences from this study to other contexts (Quinlan et al. 2015; Teddlie & Tashakkori 2009).

Before any sampling takes place however, it becomes necessary to clarify what types of companies are considered to be shipping companies operating in Australia for the purpose of this study. The need for clarification arises because the term 'shipping' has different meanings attached to it in everyday language: the process of transporting goods by any

mode of transport; the business of transporting goods by any mode of transport; or, a collection of ships. The criteria used in this study to select the sample is explained in the following sub-section.

4.4.2 Sampling criteria

Since merchant ships are heavily regulated under international conventions and codes (Bhaskar, Cahoon & Brooks 2014), the definition of 'company' provided by International Maritime Organization's International Safety Management (ISM) Code (AMSA 2016) provides a useful starting point for the type of organisation that may be considered a shipping company. The ISM Code (AMSA 2016, p. ii) applies to commercially operated ships and states that:

> company means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for the operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all the duties and responsibilities imposed by the International Safety Management Code.

As per the above definition, this study includes those companies that actually operate ships, thereby excluding all companies that provide transport services without actually operating ships themselves such as non-vessel operating common carriers.

Within the maritime industry, the term 'shipping companies' is generally applied to companies that operate ships which are: a) engaged in merchandise trade of goods and/or transport of passengers, and b) engaged in voyages between ports. Such description of shipping companies becomes apparent by, for example, referring to the LLA Directory of Maritime and Logistics Services and perusing the listings under the headings of 'shipping lines servicing Australia', 'shipping services to/from Australia', 'Australian coastal shipping' and 'specialised shipping' (LLA 2016). Similar examples can be found in well-known text books such as Maritime Economics by Stopford (2009) and Branch's

Elements of Shipping by Branch and Robarts (2014), or publications by the Institute of Chartered Shipbrokers (ICS) such as Introduction to Shipping (ICS 2005).

Although the ISM Code – as regulated in Australia through Australian Maritime Safety Authority's (AMSA) Marine Orders – clearly establishes responsibility for compliance with regulations on a single entity (AMSA 2016), in practice the operational management of ships is often shared by shipping companies with other entities such as charterers and ship managers (Branch 2005). For example, if a ship is under a time charter, the time charterer takes on many risks, responsibilities and liabilities for the commercial operation of the ship (ICS 2005). These responsibilities include decisions about which ports the ship will visit, what cargo it will load, fuel costs and costs related to the utilisation of port infrastructure (ICS 2005). The time charterer may even carry cargo belonging to third parties and issue bills of lading (ICS 2005). Hence companies that operate ships under time charter are included as shipping companies in this study.

As shown in Appendix A, the ships engaged in Australia's merchandise trade and passenger transport can be owned by either Australian or foreign companies. To manage their business in Australia, foreign shipping companies either set up local branch offices or subsidiaries, or appoint local ship's agents to act on their behalf. These ship's agents may be appointed on a temporary or permanent basis to represent the shipping company at a particular seaport (Branch 2005). Ship's agents provide services such as arranging cargo operations, ship provisions, clearing official formalities, crew transfers etc. (Branch 2005). For cruise shipping companies, agents may provide services such as inland excursions by passengers (Branch 2005). Agents may also undertake specified marketing and sales roles for their principal (Branch 2005). Though they may represent their principal, it is considered unlikely that any agent will have intimate and first-hand knowledge of the management activities of their principal that impact on the principal's

organisational resilience. This was confirmed in a telephone conversation with a maritime industry consultant (C McGuire 2016, pers. comm., 13 July). Hence, to ensure richness of data, local agents of foreign shipping companies were excluded from the sample (see Appendix B) except in those cases where the agency services were provided by local subsidiaries.

4.4.3 Primary data collection

As previously explained, the experiences and opinions of senior managers in the management of disruptions and their descriptions of activities that contribute to the development of resilience capabilities are essential to answering the research questions. Hence senior managers of shipping companies were the source of primary data for this study. The type of research that collects data by asking people questions is called survey research (Babbie 2014).

Most survey research involves collecting and analysing respondents' responses to the same set of questions (Walter 2013). There are two main methods by which respondents may be asked questions and data collected. In one method, respondents are asked to provide answers to questions either during face-to-face interviews or telephone interviews (Walter 2013). These types of surveys are called researcher-administered surveys because the researcher completes the questionnaire from the respondents' answers (Walter 2013). In the second method, questionnaires are provided to respondents by mail or electronically via internet or email. Such surveys are referred to as self-administered surveys because respondents answer the questions by themselves without direct guidance from the interviewer (Walter 2013). Both methods have their advantages and disadvantages that have been widely discussed (see, for example, Babbie 2014; Bryman

2008; Gray 2013; Singleton & Straits 2010; Walliman 2011). For this study, the telephone interview method was selected for the reasons described below.

In self-administered surveys, there is no surety that respondents have correctly interpreted the questions (Singleton & Straits 2010; Walter 2013). This is an important consideration for this study because as explained in chapters one and two of this thesis, there is no universally shared understanding of the meaning of organisational resilience. Researcher-administered surveys enable the interviewer to check the understanding of respondents and are therefore less prone to question misinterpretation (Walter 2013). Interviewers can clarify or restate questions if the respondents are unable to understand at first (Babbie 2014; Singleton & Straits 2010). Interviewers are able to provide prompts if respondents are having difficulty answering questions (Gray 2013). In addition, as this study is exploratory in nature, researcher-administered surveys enable more probing questions to be asked such as 'I am not sure exactly what you mean or can you tell me more about that?' (Singleton & Straits 2010, p. 282) which is not possible in self-administered surveys (Walter 2013). A probe is a request for elaboration that is more frequently required for open-ended rather than closed-ended questions (Babbie 2014). Further flexibility is provided by the interviewers' ability to skip questions if they do not apply, without the respondent being aware of it (Singleton & Straits 2010).

Researcher-administrated surveys have comparatively less missing data because tactful researcher explanation can often lead to respondents answering tedious or sensitive questions which they may otherwise have skipped in a self-administered survey (Singleton & Straits 2010). Dillman, Smyth and Christian (2014) suggest that verbal responses to oral questions may be easier for some respondents compared to the option of having to read questions, follow instructions and write responses in a self-administered survey. Although Dillman, Smyth and Christian's (2014) suggestion is made in the

context of respondents who may, for reasons such as low educational qualification, be under-represented in the survey due to non-response, a similar argument may be made for senior managers for whom time is one of the most valuable resource (Bartol 2011). Respondents may be less inclined to complete self-administered surveys if they require extensive writing. In general, mail surveys tend to have lower response rates than interviews (Babbie 2014). Hence, although self-administered surveys are comparatively cheaper and quicker to administer (Bryman 2008), the quality of data that is potentially available from interviews for this exploratory study means that the choice of data collection method narrowed down further to between face-to-face interviewing or telephone interviewing.

Singleton and Straits (2010) and Gray (2013) suggest that face-to-face interviews result in better response rates than telephone interviews but Bryman (2008) maintains that there is little consistent evidence to support this suggestion. One advantage that face-to-face interviews may have over telephone interviews is that it may be relatively easier to establish trust through rapport (Nandi & Platt 2017). Another advantage that face-to-face interviews may have over telephone interviews is that face-to-face interviews are more conducive to longer interviews, say one hour or more duration (Singleton & Straits 2010). This may be because respondents are more likely to get tired quickly in a telephone interview while trying to listen intently (Dillman, Smyth & Christian 2014). Time poor senior managers are also less likely to favour interviews that are of long duration, so it is prudent to design interviews that can reasonably be completed in shorter time periods. However, according to Dillman, Smyth and Christian (2014), once started, respondents seldom cut off an interview hence it is still possible to have an interview of longer length than initially planned.

Cachia and Millward (2011) note that in the research literature, the advantages of telephone interviews are consistently stated in relation to their convenience as a method of data collection rather than methodological strengths. Telephone interviewing makes it possible to access respondents who, due to their work commitments, may be hard to contact (Cachia & Millward 2011). Telephone interviews provide greater flexibility to respondents in setting up, or if necessary rescheduling, day and time of interview that is most convenient to them rather than face-to-face appointments (Cachia & Millward 2011). Perhaps the biggest advantage of telephone interviews lies in the substantial savings in time and money that can be made by interviewing respondents over the phone rather than travelling to their location for a face-to-face interview (Babbie 2014; Bryman 2008; Singleton & Straits 2010; Walter 2013). Hence for this study, where potential respondents were located over a geographically vast area, consideration of the aforementioned factors led to the conclusion that telephone interviewing was the most appropriate method of data collection.

A choice now exists between making phone calls via landlines, mobile telephony or the internet. In addition, messaging applications such as Skype, WhatsApp and Facebook Messenger offer the benefit of video and audio calls. The visual element of messaging applications offers the possibilities of better interpersonal communication and development of trust (Gray 2013). The use of messaging applications was considered for this study, but was rejected for convenience and technological reasons. Ships often visit ports that are located in remote regions where the communications infrastructure may not match the infrastructure in larger cities. The possibility that a respondent may be located at a place with poor communications connectivity, even if temporarily, cannot be discounted. Even in situations where there is appropriate connectivity, the use of messaging applications may mean additional work for respondents. For example,

respondents may be required to download and install an application on their device unless they already use it. Even if they already use a suitable application, they may need to add the interviewer to their contact list before mutual communication can take place. Considering that the use of video messaging applications potentially adds another layer of complexity in establishing contact and may even lead to more work for respondents, audio-only telephone interviews were selected as they were more likely to be convenient for the respondents and hence less likely to affect response rates negatively.

4.4.4 Secondary data collection

Secondary data was obtained to create a database of shipping companies meeting the criteria mentioned in subsection 4.4.2. To create the database, initially three secondary information sources were used – two maritime industry associations and one maritime industry newspaper. The membership lists of two peak maritime organisations in Australia – Shipping Australia Limited (SAL) and Maritime Industry Australia Limited (MIAL) – were obtained from their websites and perused. On its website SAL describes itself as an industry body established 'to promote and advance the interests of ship owners and shipping agents in all matters of shipping policy and safe environmentally sustainable ship operations' (SAL 2016). MIAL's website promotes itself as a body representing 'the collective interests of maritime businesses, primarily those operating maritime assets or facilities from Australia' (MIAL 2016). The third source referred to was the Directory of Maritime and Logistics Services 2015/16 published by Lloyd's List Australia. On its website, Lloyd's List Australia describes itself as Australia's oldest national newspaper and 'the nation's authoritative publication on shipping, trade, transport news' (LLA 2016). Information available from the websites of individual shipping companies identified from the above mentioned three sources was checked to determine whether the companies actually operated ships. This resulted in an initial list of 66 companies to which another

eight companies that the researcher knew were operating in Australia were added to give a total of 74. However, closer inspection of company details, information provided by potential respondents and new developments reported by newspapers reduced the number of shipping companies meeting the sample criteria to 57. The breakdown of companies not meeting the sample criteria was as follows: three relied on other companies to operate their ships; eight were represented in Australia by local agents only; two were being operated from offices outside Australia; one went bankrupt; one withdrew from Australia; and, two did not operate ships in Australia.

4.5 Telephone interview questionnaire

A questionnaire is 'an instrument specifically designed to elicit information that will be useful for analysis' (Babbie 2014, p. 248). A questionnaire may contain both questions and statements (Babbie 2014). The Questionnaire (Appendix C) used for this study was designed as a semi-structured instrument consisting of open-ended questions, closed-ended questions and statements reflecting the mixture of qualitative and quantitative approaches in the study. The questions and statements in the Questionnaire were arranged in six sections:

- A Disruption Management;
- B Awareness;
- C Learning;
- D Innovativeness;
- E Robustness; and
- F Demographics.

Questions and statements were formulated utilising the approach suggested by Kumar (2014). First, the information needed to answer each SRQ was identified and then

questions and statements were formulated to obtain the required information. Having a clear idea about the information being sought was considered essential for developing specific questions to gather the necessary data (Walter 2013). Kumar's (2014) recommendation was adopted to ensure that every question in the survey had a clear rationale (Walter 2013). Table 4-2 maps the information required and the questions and statements formulated to obtain that information for each SRQ.

Table 4-2: Mapping of SRQs and questions asked

SRQ	Information required	Survey question/item number
SRQ1: *Which organisational capabilities contribute to the resilience of shipping companies?*	• Impact of any disruption on the company • Company's response to any disruption • Lessons learnt from disruption • Company's response to any threat of disruption • Lessons learnt from any threat of disruption	A.5-A.14 A.17-A.26
SRQ2: *How do senior managers of shipping companies develop their organisation's resilience capabilities?*	• Organisational changes made as a consequence of any disruption • Organisational changes made to cope with any threat of disruption • Measures taken to reduce the likelihood as well as impact of disruptions • Extent of activities that influence company's awareness • Extent of activities that influence company's learning ability • Extent of activities that influence company's innovativeness • Extent of activities that influence company's robustness	A.15, A.16 A.27-A.36 B.1-B.21 C.1-C.16 D.1-D.18 E.1-E.18
SRQ3: *How is organisational resilience characterised by senior managers of shipping companies?*	• Respondent's description of the meaning of resilience and its use in their company	A.37-A.42
Demographics	• Respondent profile • Company size (number of ships and employees) • Type of operation	A.1-A.4 F.1-F.5

4.5.1 Response formats

This study seeks the in-depth opinions and experiences of senior managers of shipping companies. As explained in section 4.3 of this chapter, both qualitative and quantitative data is required to answer the SRQs. Hence a semi-structured rather than a highly structured questionnaire instrument was considered more appropriate for this study.

Open-ended questions were posed in six situations where the Questionnaire sought narrative data:

1. Questions asking respondents to describe the latest disruption, or threat of disruption, experienced (A.7-A.10, A.12, A.14, A.16, A.19, A.21-A.24, A.26, A.28). Respondents were asked to explain the latest disruption or threat of disruption experienced as they were more likely to recall recent rather than older events reliably (Babbie 2014; Bryman 2008; Singleton & Straits 2010).

2. Questions asking respondents to describe any specific measures taken to reduce the likelihood or impact of disruptions (A.30, A.34).

3. Questions asking respondents the reasons for rating their company's performance utilising ordinal measurement scales (Kumar 2014; Singleton & Straits 2010) (A.31, A.35, A.41).

4. Questions asking respondents to describe their understanding and use of the term resilience (A.39, A.40)

5. Questions asking respondents to report activities, other than those stated in Sections B, C, D and E of the Questionnaire, that could influence awareness, learning ability, innovativeness and robustness in their company (B.21, C.16,

D.18, E.18). These questions were included so that respondents had an opportunity to state activities occurring in their company that were not captured in the literature review and therefore not listed in the Questionnaire.

6. Questions asking respondents to explain their role (A.1) and their company's business (A.4). These questions enabled confirmation or gathering of information that may not have been clear from secondary sources. Open-ended questions at the beginning of the Questionnaire were used to motivate respondents to express themselves (Singleton & Straits 2010).

Use of open-ended questions means that data processing and analysis will likely be more laborious and difficult in comparison to closed-ended questions (Babbie 2014; Bryman 2008; Gray 2013; Kumar 2014; Singleton & Straits 2010). As Bryman (2008) explains, the difficulty arises because answers - which can be several sentences long - have to be categorised so that responses from all respondents can be aggregated for a particular question. Open-ended questions do enable any number of categories to be developed during analysis (Kumar 2014). This is explained in the next chapter. Overall, the richness of the data potentially obtainable and the opportunity to ask probing questions made the use of open-ended questions an attractive choice for this exploratory research.

In addition to narrative data, the Questionnaire was also designed to obtain numeric data as follows:

1. Demographics (A.2, A.3, F.1-F.5). Two indicators were used for shipping company size – number of vessels and numbers of employees. The categorisation used for number of vessels (F.3) was as per the classification of shipping companies into small, medium or large by Stopford (2009). The categorisation used for number of employees (F.4) was as per the Australian Bureau of Statistics

classification of businesses into small, medium and large businesses (ABS 2016). In surveying companies that operate from several locations, what constitutes an organisational entity needs to be clarified because the respondent's answers may be location-specific (Dillman, Smyth & Christian 2009). Hence question A.3 was designed to seek such clarification.

2. Contingency questions (A.5, A.6, A.11, A.13, A.15, A.17, A.18, A.20, A.25, A.27, A.29, A.33, A.37, A.38). Contingency questions were used as filters so that respondents were only asked questions that were relevant to them (Walter 2013). This was done to reduce time wastage and possible reduction in respondent motivation if the same questions were asked of all respondents (Singleton & Straits 2010).

3. Rating questions (A.31, A.35, A.41). Respondents were asked to separately rate their company's effectiveness in reducing likelihood of unexpected disruptions, preparedness to withstand impact of unexpected disruptions, and resilience utilising ordinal measurement scales.

4. Likert scales (B.1-B.20, C.1-C.15, D.1-D.17, E.1-E.17). Respondents were asked to indicate their level of agreement or disagreement with statements about activities occurring in their company in relation to awareness, learning, innovation and robustness capabilities.

In Chapter Three, dimensions and indicators of organisational resilience capabilities were identified from synthesis of the literature. These were used to create statements for each item in sections B, C, D and E of the Questionnaire with the intention that the level of respondents' agreement or disagreement on the Likert scale would indicate the extent to which activities influencing their organisation's awareness, learning ability,

innovativeness and robustness were occurring. Likert scales are quite useful in telephone interviews because they enable information to be captured quickly and easily from respondents (Cahoon 2004). Hence the use of Likert scales for 69 items in the Questionnaire helped keep the interview duration to a manageable level. Table 4-3 maps the Likert scale items used in this study against the indicators of resilience capabilities identified in chapter three.

Table 4-3: Mapping of Likert scale items

Capability	Dimension	Indicator	Items
Awareness	Social capital	Interaction and collaboration among employees	B.5-B.8, B.14-B.16
		Employee knowledge of organisation	B.1-B.4, B.20
	Networking	Business environment awareness	B.9-B.13, B.17
		Stakeholders' expectations awareness	B.18, B.19
Learning ability	Learning culture	Freedom of expression	C.1, C.2, C.5
		Learning capability development	C.3, C.4, C.6, C.7, C.11, C.12
	Knowledge creation processes	Scenario simulations	C.8, C.9
		Learning from failures	C.13-C.15
		Decision-making training	C.10
Innovativeness	Staff empowerment	Delegation	D.4, D.6, D.8
		Competency development	D.12-D.14
	Supportive leadership	Shared purpose and values	D.1, D.2, D.17
		Support for innovation	D.3, D.5, D.7, D.9-D.11, D.15, D.16
Robustness	Recovery planning	Plans for recovery	E.1, E.5
		Training and practice	E.2-E.4, E.6-E.8
	Modularity and response diversity	Back-ups	E.9-E.15
		Business diversity	E.16, E.17

The format for indicating the level of agreement or disagreement in a Likert scale is usually a five-point scale ranging from 'strongly agree' to 'strongly disagree' with a middle position indicating neutrality (Bryman 2008). This study utilised a similar approach but with the addition of a sixth point 'not applicable' to allow for instances where some statements may not be applicable to all companies. According to Bryman (2008), since Likert scales measure intensity, for coding purposes high scores are usually awarded to high levels of intensity of agreement with each statement. Taking a similar approach 'strongly disagree' responses were scored as one (1) and 'strongly agree' responses were scored as five (5) in this study, with 'not applicable' responses scoring a zero (0). As the scaling instructions might be difficult for respondents to remember during a telephone interview, Singleton and Straits (2010) recommend presenting the respondents with a visual aid such as a card containing all responses to the Likert scale items. Accordingly, a Response Card (Appendix D) adapted from Cahoon (2004) was prepared for this survey.

In writing questions and statements in the Questionnaire, care was taken to ensure that:

- Double-barrelled statements were avoided. Double-barrelled statements are those that contain two rather than one question in them (Bryman 2008; Walter 2013). The word 'and' in a question or statement often implies that a double-barrelled question is being asked (Babbie 2014). Except for items B.1 and B.2, the word 'and' did not appear in any other item. In items B.1 and B.2 the meaning of the phrase 'roles and responsibilities' is likely to be clear to senior managers and splitting the phrase in two statements, one with 'roles' and another with 'responsibilities' may cause confusion.

- Negative terms were kept to a minimum. Negative terms in a question can be misunderstood by respondents who might answer a question opposite to the way they intended (Babbie 2014). However, negative terms are sometimes difficult to avoid in Likert scale items (Bryman 2008). Statements in the Questionnaire were worded in a way that all items were scored in the same direction. This ensured that there was no need for reverse coding (Zikmund et al. 2013) but it also meant that two items, D.4 and D.6, contained negative terms. However, negative items can be useful in identifying respondents who display response set (Bryman 2008; Walter 2013).

- Questions or statements that might appear to lead the respondents towards a particular answer were avoided. Prompts were written into the questionnaire next to some questions and statements where it was thought that some respondents may have difficulty in providing an answer (See, for example, question A.5 and item B.11).

4.5.2 Design and format of questionnaire instrument

Babbie (2014) points to the importance of questionnaire format by highlighting problems that can arise from using an improperly formatted instrument: for example, the interviewer may miss some questions; lose the sequence of questions; and/or may become flustered and frustrated. To mitigate such problems, questionnaire instruments should be formatted to support the interviewer, including any special instructions or guidelines (Babbie 2014). The aim should be to help the interviewer move easily through the questionnaire, for example, by using an easily readable font and generous spacing and margins (Bourque & Fielder 2003).

The Questionnaire instrument for this study followed Cahoon's (2004) recommendation of using different font sizes for text that was read aloud and text that contained instructions or suggested prompts for the use of the interviewer. Text to be read aloud was written in Calibri (Body) style font size 11, whereas instructions and prompt suggestions were written in italicised Calibri (Body) style font size eight. Routeing instructions were boxed so they could be located and acted upon quickly without interrupting the flow of the interview (see, for example, A.5). Where the questions contained a choice of alternative words based upon the respondent's answer to a previous question, such words were underlined (see, for example, A.21).

Attention was given to keep the sequence of questions logical and simple. The bulk of open-ended questions were asked first so that respondents had a chance to express themselves freely right from the beginning rather than having to listen to Likert scale statements being read out by the interviewer and thus perhaps losing interest. Questions were grouped together in themes as recommended by Kumar (2014). Respondents were asked to describe their experiences of actual disruptions first, followed by their experiences of actual threats of disruptions, before being asked their opinion and understanding of the term 'resilience'. Likert scale statements were grouped together so that each set of statements related to a specific organisational capability. Transition statements were used when moving from one section of the questionnaire to another. As suggested by Cahoon (2004), to keep the respondents' interest up, they were told that the interview was nearly at the end prior to reading aloud the last set of Likert scale statements. Despite the logical progression of questions in the Questionnaire prepared beforehand, Bryman (2008) advises the interviewer to be prepared to alter the order of questions during the actual interview to suit the respondent's narrative.

4.6 Survey administration

In preparation for the survey, four documents were prepared for the benefit of respondents containing essential information and tools. These were:

- Response Card (Appendix D, as discussed in section 4.5)
- Advance Letter (Appendix E)
- Participant Information Sheet (Appendix F)
- Consent Form (Appendix G)

The Advance Letter was sent to prospective respondents as an email message with the other three documents attached to the email as pdf files.

An advance letter is basically a cover letter mailed a few days before the interviewer calls the respondent (Singleton & Straits 2010). The purpose of the advance letter is to persuade the respondent to participate in the study (Bourque & Fielder 2003; Singleton & Straits 2010). Advance letters 'underscore the legitimacy of the survey, take away suspicion, communicate the value of the survey, and evoke the principles of social exchange and reciprocation' (De Leeuw et al. 2007, p. 414). Response rates are increased by using advance letters as compared to cold-calling (Cachia & Millward 2011). In a meta-analysis of twenty nine studies, it was found that advance letters improved telephone interview response rates by eight per cent (De Leeuw et al. 2007).

The Advance Letter used in this study followed the recommendations of Singleton and Straits (2010) by including the following information:

- Title and purpose of the study
- The institution where the study was being conducted
- Names and contact details of the researcher and supervisors as well as the institutional logo in the email signature

- Reason why the respondent was being contacted
- Interview duration
- Promise of confidentiality
- Ethics approval by the institution. The Participant Information Sheet and the Consent Form developed for this study were based on the template required by the Tasmanian Social Sciences Human Research Ethics Committee for approval of research projects.
- Promise of a summary report of findings after the conclusion of study

The promise of a summary report of findings was used as an incentive to make participation attractive to senior managers of shipping companies. According to Dillman (2014), people's participation in a survey is affected by how they perceive the expected reward vis-à-vis their cost of participation. Zikmund (2013) recommends that respondents should receive some incentive to respond. In both the Advance Letter and the Participant Information Sheet used for this study, the respondents were advised that the summary report would enable them to benchmark their company against other shipping companies operating in Australia. It was further pointed out that the study could be useful in understanding new practices which could assist senior managers in developing future strategies for their own companies. This information was conveyed to emphasise the study's personal relevance to the respondents (Bourque & Fielder 2003).

The introduction to the Questionnaire and the closing statements (Section G) were adapted from Cahoon (2004). Two options were created for the opening sentences in the Introduction depending upon whether there had been a previous phone contact with the respondent or not. Before proceeding to the main body of survey questions, respondents were assured of confidentiality and asked to confirm: their consent for the interview; their

consent for recording the interview; and, whether they had the Response Card at hand. In the closing comments, respondents were asked if they had any questions and comments on the study or the topics covered (G.1) as suggested by Bourque and Fielder (2003). This gave the respondents further opportunity to express themselves. At the completion of the interview, respondents were asked to pass on relevant information about the study to any other potential respondent whom they knew, on the chance that such persons may not have been previously identified by the researcher. Using respondents to locate potential respondents is a process known as snowballing (Babbie 2014; Gray 2013; Kumar 2014; Zikmund et al. 2013). In this study snowballing was not used as the primary sampling method, but rather as a strategy to increase coverage of sample.

As suggested by Gray (2013), a preliminary phone call was planned to set up a time for the interview. To manage the conversation, a Confirmatory Telephone Call document (Appendix H), adapted from Cahoon (2004) was prepared to record important items. The Confirmatory Telephone Call document contained alternative actions and scripts for the researcher to follow depending upon whether the potential respondent agreed or declined to participate in the study. An important inclusion was the series of steps that could be taken if the respondent declined to participate. As per Cahoon (2004), such respondents were asked to suggest the contact details of another person whom they considered suitable for interviewing failing which they were asked if they could agree to answer three quick yes/no type questions. This way, an attempt was made so that the contact with the respondent was not entirely wasted. Since it is important to match the timing of the calls to respondents' availability (Walter 2013), initial phone calls to respondents based in the state of Western Australia were made after five p.m. Australian Eastern Standard Time. The Australian Eastern Standard Time is three hours ahead of the time in Western Australia during the Australian summer. An assumption was made that once offices in

the eastern states of Australia had shut down, there would be less phone traffic and hence more chance that the respondent would be able to take the researcher's call.

4.6.1 Pretesting

The Questionnaire, Advance Letter, Participant Information Sheet, Consent Form, Response Card and the Confirmatory Telephone Call document (Appendix H) were pretested prior to conducting the actual survey. The purpose of pretesting these documents was to determine whether they served the purpose intended, or whether further revision was needed (Singleton & Straits 2010). With respect to the Questionnaire, pretesting was carried out to determine whether the questions were unclear, biased or ambiguous (Zikmund et al. 2013) or if they contained mistakes and other errors.

The documents were pretested by a total of 20 persons including 14 academics, six of whom had prior experience working in the shipping industry as professionals, four shipping industry professionals and two persons from outside academia and the shipping industry. As suggested by Gray (2013) information and instructions were provided to the pretesting persons in the form of an Invitation Letter (Appendix I) outlining the research questions, interview process, layout of the Questionnaire, and suggested key issues for consideration. The suggested key issues for consideration were adapted from Cahoon (2004) and grouped in three areas: layout issues relating to the flow and clarity of information; issues related to completing the Questionnaire such as time taken, ambiguity or bias apparent in the questions, and difficulty in completion; and, issues relating to the purpose of the survey such as omission of particular topics and irrelevant questions.

After receiving the feedback from pretesting, minor changes were made to the Questionnaire, Advance Letter, Participant Information Sheet and Consent Form. Subsequently, three practice interviews were conducted separately with three different

academics. The two main reasons for conducting the practice interviews were, first, to check whether the stated duration of 30 minutes was appropriate, and second, to identify any shortcomings in the interview skills of the interviewer. All three practice interviews were recorded and reviewed afterwards, together with feedback received from the participants. The major items for which feedback was sought from participants were:

- Was the interview too long or too short?
- Were all questions understood?
- Was the interview conducted in a business-like manner?
- Did the participants become bored or fatigued?
- Were the participants offended by anything that the interviewer did or did not say?
- Were any queries by the participants not answered satisfactorily?

Feedback received from the practice interviews confirmed that the interview duration of 30 minutes was appropriate. Feedback also revealed that while replying to a particular question, practice interviewees would often provide a wide ranging answer that would cover information sought by other questions in the questionnaire. This meant that the interviewer had to be careful in not asking a question later for which the answer had already been provided so as not to irritate the respondent. Following the practice interviews, the Questionnaire and supporting documents were sent to the Tasmanian Social Sciences Human Research Ethics Committee for approval which was duly obtained to commence the survey.

4.6.2 Contacting respondents

According to Bourque and Fielder (2003) and Mikecz (2012) telephone interviews with elites - individuals of high status or those with high levels of responsibility such as senior managers of companies - are among the most difficult to do. Elites typically have busy

schedules with little time to spare (Bourque & Fielder 2003). Contacting elites often requires getting past gatekeepers whose responsibilities include screening out unsolicited calls (Bourque & Fielder 2003; Mikecz 2012). Making contact is therefore mainly a matter of persistence and overcoming barriers (Singleton & Straits 2010). For this study, a decision was made to contact senior managers of shipping companies directly where possible, bypassing gatekeepers initially. Several sources were utilised to obtain the contact details of respondents as detailed below.

Official endorsement of the study by relevant organisations can be useful in gaining access and cooperation of respondents (Singleton & Straits 2010). For this study, the CEOs of SAL and MIAL were approached and the purpose and contribution of the study explained to them. Both CEOs agreed to circulate details of this study, including the Participant Information Sheet, to their respective members. Additionally, the CEO of SAL spoke about this study at a meeting of SAL members. The intention of SAL and MIAL circulars was to encourage members to contact the researcher directly if they were interested in participation.

To obtain contact details of respondents whose companies were not members of SAL or MIAL, and those who didn't respond to SAL or MIAL circulars, individual websites of companies were perused. In some cases, senior managers' contact details were available from the companies' websites. For others, use was made of the Company 360 database to extract the names of senior managers. These names were then searched for in the business community social networking site LinkedIn. Respondents who had a profile on LinkedIn were contacted utilising the LinkedIn messaging service. For the remainder, and in cases where the names of respondents could not be obtained utilising the means mentioned above, attempt was made to approach them via gatekeepers who were contacted using the company contact details available on companies' websites or Company 360 database.

4.6.3 Conducting interviews

Gray (2013) recommends the use of a recording device when the interview involves open questions because it is difficult to transcribe verbal dialogue. To reduce the possibility of error caused by misinterpretation of information while writing down answers (Bryman 2008), a digital voice recorder was used to record interviews in this study. Agreement to record the interview was obtained from all respondents except one. Accordingly, the interview of the respondent who denied permission to record was transcribed by hand. All other interviews were recorded. Prior to all interviews the voice recorder was checked for memory and battery status. A speaker phone was utilised so that the voice recorder could capture the full dialogue. It was anticipated that some respondents might adjust the prearranged interview time at the last minute, or offer to call back at some later time without being able to confirm the time for interview beforehand. Hence, during the data collection phase, the interviewer carried the voice recorder, a mobile phone, and spare set of interview questionnaire instruments at all times during normal business hours.

Prior to each interview, as much as possible demographic data about the specific shipping company was collected beforehand. This ensured that more of the interview time could be devoted to respondents' experiences, attitudes and opinions about organisational resilience. Furthermore, by knowing the demographic details of the companies beforehand, the interviewer was better prepared to contextualise the respondents' comments and ask probing questions, or provide prompts, that were meaningful to the respondent.

At the start of the interview, respondents were asked if the prearranged time for interview was still convenient for them. If the answer was affirmative, consent was sought to record the interview. In cases where written consent form had not been previously received,

verbal consent to proceed with the interview was sought and recorded. The respondents were also asked whether the previously sent Response Card was at hand. An email with the Response Card attached was kept ready as suggested by Cahoon (2004) in case the respondent needed one quickly.

Establishing rapport with the respondent is vital in an interview (Babbie 2014; Mikecz 2012) otherwise the respondent may not provide high quality answers and may even cut the interview short (Gray 2013). Babbie (2014, p. 310) defines rapport as an 'open and trusting relationship' between the interviewer and respondent. Establishing rapport requires the interviewer to 'remain objective, professional and detached yet relaxed and friendly' (Gray 2013, p.392). Compared to face-to-face interviews, it is more difficult to establish rapport in telephone interviews because the obvious visual cues of friendliness such as eye contact and smile are absent (Bryman 2008). Stephens (2007) suggests that while interviewing elites, mutual awareness and understanding of each other's cultural positioning may help the participants achieve rapport. Therefore, in all correspondence between the researcher and respondents in this study, wherever the credentials of the researcher were displayed, they included the words 'master mariner' to indicate the seafaring qualifications of the researcher and the researcher's links with the shipping industry (see, for example, the Advance Letter and the Participant Information Sheet).

4.7 Error control

Many errors can arise in the design, collection, processing and analysis of data that may cause a survey response to deviate from its true value (Gray 2013). Bias and variance (or variable error), are the two main sources of total survey error which results from the accumulation of all errors (Gray 2013; Groves 2002). In the context of interview questionnaires, bias refers to 'any property of questions that encourages respondents to

answer in a particular way' (Babbie 2014, p. 253). Therefore bias is a source of systematic error (Gray 2013; Singleton & Straits 2010). In designing the Questionnaire for this study, effort was made to avoid asking leading questions or using words that were vague or ambiguous. During the pretesting phase of the Questionnaire, the pretest sample were specifically asked in the pretesting Invitation Letter to look for bias and ambiguity.

Biases may be created not only by the wording of questions, but also the interaction between interviewer and respondent (Singleton & Straits 2010). The social situation surrounding an interview can lead to problems such as social desirability response bias and acquiescence response bias (Singleton & Straits 2010). Social desirability response bias can arise because people tend to answer questions in a way that makes them look good (Babbie 2014). Many respondents want to make a good impression on the interviewer and may be hesitant to provide sensitive information that reflects negatively on themselves (Babbie 2014). People answer in a way that will make them look good but this bias may be more noticeable in a face-to-face interview than in a telephone interview (Babbie 2014; Nandi & Platt 2017). Acquiescence response bias may arise due to the tendency shown by some respondents is to be very agreeable (Singleton & Straits 2010). They are more likely to agree than disagree with statements using Likert scale format (Singleton & Straits 2010). However, social desirability bias and acquiescence bias may be less prevalent among elites such as senior managers who, due to their position of power and raised social status, may be expected to be confident speakers 'familiar with adopting the leading role in a conversation and dictating the topic' (Stephens 2007, p. 208).

Wherever measurement is used, error variance is present (Punch 2005). Measurement errors can arise from the interviewer, respondent, the questionnaire and the mode of data collection (Groves 2002). Measurement errors occur randomly and, by varying across questions and respondents, are unpredictable (Singleton & Straits 2010). Bryman (2008)

suggests that using a structured interview with closed-ended questions can reduce error variance because this approach standardises both how questions are asked and how answers are recorded and coded. As previously discussed, a highly structured quantitative approach is inappropriate for this exploratory study which requires a certain amount of open-ended questions to be asked. As the coding process requires the interviewer to interpret the meaning of open-ended responses, it opens up the possibility of researcher bias (Babbie 2014). However, semi-structured interviews such as those used in this study, do allow the interviewer to probe or clarify the meanings of responses if required.

In purposive sampling, there is a risk that the researcher may be unknowingly biased in selecting a sample, or may omit a key criterion in selecting a sample (Gray 2013). In addition, Singleton and Straits (2010) maintain that the researcher must have considerable knowledge of the population before the sample is selected. To ensure maximum coverage, three separate lists - memberships of SAL and MIAL as well as the Lloyd's List Australia directory – were sourced to draw up the initial list of shipping companies operating in Australia. The possibility that the sourced lists would represent the presence in Australia of liner shipping companies to a greater extent than the presence of tramp shipping companies was actively considered. Liner shipping companies publically publish details of their operations such as port visit schedules of their ships because they rely on relatively large numbers of shippers utilising their fixed schedule services. In contrast, tramp shipping companies rely on brokers to bring them into contact with charters. Whereas a liner shipping company will typically conduct 10,000-50,000 revenue transactions per ship per year, a tramp shipping company will typically conduct five or six revenue transactions per ship per year (Stopford 2009). As a result, liner shipping companies maintain greater market visibility than tramp shipping companies. Since no other list of shipping companies operating in Australia was available, this study relied on

the researcher's personal contacts in the maritime industry to further update the initial list of shipping companies. This was assisted by keeping in touch with the latest developments such as by subscribing to news updates sent by emails from maritime news providers including Lloyds List Australia, WorldCargo News Online, Maritime Reporter E-news, Splash24/7, Port Technology, American Shipper and Maritime Logistics Professional.

Being able to successfully contact respondents initially is a necessary requirement for improving response rates (Bourque & Fielder 2003). The strategy employed in this study was based upon Dillman, Smyth and Christian's (2009), and Gray's (2013) recommendation that knowing the names and job titles of respondents in advance and using multiple ways of contacting them is critical to achieving higher response rates. Hence individual companies' websites, Company 360 database and LinkedIn were used extensively to locate respondents. Gatekeepers were approached only when respondents' details were not available from secondary sources or in cases of non-response after initial attempts at contact were unsuccessful. Approaching gatekeepers in cases of non-response allowed for the possibility that some respondents may have changed jobs or companies. The closing statement of the interview contained a request to respondents to pass on the details of this study to other interested persons, thus increasing the likelihood of participation by respondents not previously identified.

To increase motivation of senior managers to respond, several measures were employed, for example: relying on interviews rather than self-administered questionnaires, thereby reducing the effort needed for participation; sending advance letters instead of cold calling; promising incentive in the form of a report on study findings that could be used for benchmarking; promising confidentiality; building rapport through credentials; calling respondents on their mobile phones first to make it easier for them to reply; giving

respondents choice to nominate date and time for interview. By not sending the Questionnaire to respondents in advance, the chances of recipients perusing the content before deciding their participation were minimised (Dillman, Smyth & Christian 2014).

4.8 Summary

This chapter explained how the requirements for answering research questions shaped the design and methodology of this study. The sampling decision to survey senior managers of shipping companies operating in Australia was justified and a list of 45 companies meeting the sampling criteria drawn up. Telephone interviewing was determined to be the most appropriate method of data collection from the elite sample of senior managers. The Questionnaire developed was designed to seek both numeric and narrative data to ensure that all necessary topics were covered during interview while still giving respondents freedom to express themselves. The survey administration process was explained including the pretesting procedure. The chapter closed with a discussion on measures taken to control both systematic and random errors. The next two chapters analyse the data collected. Quantitative data will be analysed using the IBM SPSS statistical software package version 23.

CHAPTER 5: MANAGEMENT OF DISRUPTIONS

5.1 Introduction

This chapter is the first of two chapters containing the findings of the survey and analysis of data obtained. The chapter starts with a discussion on response rates, followed by a description of the characteristics of shipping companies represented by the respondents, as well as the characteristics of the respondents themselves, in order to contextualise the findings. This is followed by a discussion of findings related to the experiences of respondents in managing actual disruptions. The chapter focusses on identifying organisational capabilities that contribute towards the ability of companies to withstand disruptions.

5.2 Response rate

As mentioned in Chapter Four, the sampling frame was established by identifying 57 shipping companies operating in Australia (Appendix A). A total of 30 interviews were conducted from 29 senior managers representing 32 companies. The differences between the number of interviews conducted, the number of individuals who responded, and the number of shipping companies represented by the respondents is explained as follows. One respondent, while being interviewed as the managing director of a company, revealed that he is also a director on the board of another shipping company. Hence, two separate interviews were conducted from this respondent. Data from these two interviews is treated as being from two separate respondents because the companies operated in distinctly different markets, operated different types of ships, and had different organisational structures. Two other respondents revealed during the interviews that they individually represented not one, but two, shipping companies. In one instance, a respondent disclosed that two separate subsidiaries of a foreign shipping company in Australia were being managed as one because they were owned by the same parent company. In another

instance, the second respondent revealed that their shipping company part-owned another shipping company in a joint-venture, but was fully responsible for managing the joint-venture company. Hence in the preceding two instances, since there are two sets of senior managers managing four companies, data is treated as being from just two, and not four, companies. However, since these companies are listed as separate companies in the sampling frame, the response rate for this study is calculated as 32/57 which equals 56.14 percent.

In Chapter Four, the selection of telephone interviewing as the preferred method of data collection was justified on the basis that the flexibility provided by this method would enable senior managers to participate at a time and place convenient to them. All interviews for this study were conducted at times nominated by the respondents. The telephone interviews provided convenience to the respondents which was manifested in several ways. For example, three respondents reported that they were driving their car while being interviewed and thus not taking up valuable time in the office. Another interview was conducted while the participant reported being at home and having breakfast which he explained as being more convenient. Three respondents specifically mentioned that the Christmas to New Year holiday period would suit them because they would be more likely to be able to focus on the interview without work related distractions. One respondent mentioned that they were agreeable to the interview after most of their office staff had left the company premises for Christmas holidays. Accordingly, their interview took place at 2 p.m. on 23 December. Another interview took place on 29 December because the respondent mentioned that with few people around, he was less likely to be interrupted. One respondent indicated preference for the interview to be conducted on the morning of her first day back at work after the New Year holidays as this would be a '*quiet period*' (CEO, Company #24). The flexibility and

convenience provided by telephone interviewing may have contributed positively to the response rate in this study.

The duration of interviews ranged from 24 to 59 minutes, with average duration being 41.13 minutes. All interviews were completed without any respondent terminating their interview or refusing to answer a question. Most respondents expressed keenness to receive the report on findings that was promised to them as an incentive to participate. One respondent commented that the report on findings '*will certainly be interesting and could be beneficial [to their company] as well*' (Senior Manager, Company #19). Another respondent commented that '*your study is very timely, given what is occurring now*' (CEO, Company #2). Such examples illustrate the interest of the respondents in the topic of this study.

Initial attempts at making contact with potential respondents were directed at managing directors and CEOs of shipping companies. In cases where attempts to contact potential respondents were unsuccessful, their LinkedIn profiles, where available, were checked to see if they had moved jobs. Five such cases were observed. In only one of the five cases the potential respondent was contacted again because their new job was the managing director of another company in the sampling frame. The remaining four were not contacted because the person had either moved overseas, taken a job with a non-shipping company, or retired and thus not within the eligible sample. In all cases where multiple attempts to establish contact via phone calls, emails and LinkedIn messages failed to elicit a response, shipping companies' websites and the Company360 database were investigated to identify other suitable senior managers with whom attempts were made to establish contact.

The interviews were conducted over a period of six months due to a number of reasons. The process of establishing telephone contact with the respondents for example, often took multiple attempts. Phone calls were routinely diverted to answering machines or gatekeepers. When the initial phone contact was established, it was often the case that the respondents had not read the email containing the Advance Letter and associated documents. This necessitated the need for another call to allow the respondents to read the email and its content before being asked to give their consent for participation. Even when consent was given and a time and date arranged for the interview, it was not uncommon for the interviews to be postponed by respondents citing unexpected work-related commitments. Similar to Harvey's (2011) and Mickez's (2012) findings, this study also found that getting access to elites and arranging suitable times for interviews is challenging.

Despite difficulties in gaining access to elite managers, 30 interviews were carried out in this study which represents getting primary data from 32 out of the 57 companies in the sampling frame as shown in Table 5-1.

Table 5-1: Companies surveyed

	Number of companies	**Percentage of companies**
Companies surveyed by conducting 30 interviews	32	56.14%
Companies whose respondents agreed to be interviewed but were unable to confirm date/time	5	8.77%
Companies whose respondents declined to be interviewed	2	3.51%
Companies whose potential respondents did not respond to offer of participation	18	31.58%
Total (sampling frame)	57	100%

Of the remaining 25 companies, contact was established with potential respondents from seven companies. Five of these seven potential respondents could not confirm a suitable date and time for interview even though they had agreed to participate. Two of the seven declined to participate. There was no response from potential respondents from eighteen companies.

According to Singleton and Straits (2010), non-response can occur because either respondents are not able to be contacted successfully or some actively refuse to participate. In this study, a third category of non-response was observed – those people who were unable to participate despite being agreeable to the interview. As shown in Table 5-1, there were five such cases. Only two potential respondents declined to participate outright. One potential respondent's gatekeeper refused by saying that their company did not participate in research studies while the second potential respondent said that they did not feel comfortable discussing their company's affairs. It had been anticipated that confidentiality would be of major concern to respondents and the Advance Letter, Participant Information Sheet and Consent Form were clearly worded to assure respondents how their confidentiality would be maintained. During pre-interview phone conversations, a number of respondents sought further assurance that their identity as well as their company's identity would not be revealed. Considering the likelihood that many senior managers in Australia would know each other, the respondents were assured that all efforts would be made to avoid deductive disclosure (Kaiser 2009). The respondents were assured that there would be no mention in any publication of any details relating to an event, company characteristics or company performance that would enable someone to deduce the identity of a person or company. All potential respondents with whom conversation took place about deductive disclosure agreed to be interviewed except the one aforementioned person who declined.

When considering the likely reasons for non-response, experience with respondents suggests that many senior managers of shipping companies operate in a fast-moving, dynamic, globalised and highly competitive environment. There remains the possibility that details of this study may have escaped the full attention of some potential respondents who may have had other pressing priorities. Some examples of the priorities mentioned by respondents when arranging or postponing previously arranged interviews were: participating in merger talks with another company; preparation of important tender documents; own company being sold to another company; and, frequent overseas travel. In addition, during 2016 considerable consolidation activities took place in liner shipping. As reported by various shipping news outlets such as Lloyds List, American Shipper, Maritime Reporter E-news and Splash24/7, three new global shipping alliances were announced – 2M consisting of Maersk Line and MSC, Ocean Alliance consisting of CMA CGM, COSCO, OOCL and Evergreen Line, and THE Alliance consisting of NYK Group, MOL, "K" Line, Hapag-Lloyd and Yang Ming. Hamburg Sud was bought over by Maersk Line and Hapag-Lloyd announced merger with UASC. In such a dynamic environment, attracting the attention of senior managers was a critical first step in collecting adequate data for this study. As mentioned in Chapter Four, two industry associations – SAL and MIAL – were approached to circulate details of the study to their members. This resulted in three respondents whose companies were in the sampling frame, approaching the researcher voluntarily to participate in the study. Two other respondents whose companies were also in the sampling frame, mentioned during the interview that they had heard about this study through the industry associations.

Conversations with respondents revealed that most had not read the email containing the Advance Letter prior to receiving a phone call from the researcher. One respondent mentioned that their email went to their gatekeeper. Two other respondents said that they

had read the email but were waiting for the survey to be mailed to them, suggesting that they may not have read the Advance Letter in depth. Such examples highlight the limitations of emails in attracting senior managers' attention and the necessity of employing all other reasonable means such as phone calls and social media platforms such as LinkedIn. Two respondents were only able to be contacted initially using LinkedIn. This study therefore suggests that any information arriving by email can easily be dismissed or ignored by elites without looking at the details and how useful it could be for them. Hence disseminating information by multiple methods used in this study such as emails, telephone calls, social media platforms and circulars by industry associations may be necessary to gain elites' attention.

At the conclusion of each interview, respondents were asked to forward the details of this study to any other participant that they considered suitable. Many respondents voluntarily suggested names of other companies to include in the survey. In all cases except one, the companies were already included in the sampling frame. Only one company was identified that was not in the original list of companies from which the sampling frame was drawn, suggesting that any coverage error in compiling the sampling frame is small. The company is not a member of SAL or MIAL. One other possible reason why this company was not identified initially is that the company mainly operates vessels to support marine construction activities while the sources from which the sampling frame was developed as explained in Chapter Four tend to focus heavily on companies providing liner/tramp services or companies providing offshore support to the oil and gas industries.

5.3 Company characteristics

To assist in data analysis for this study, shipping companies are stratified by three characteristics: their size; the segment of the shipping market they operate in; and,

whether they are limited to operations in Australia only. The rationale for stratification is based on the likelihood of variance in response from companies who possess different characteristics. Company size is chosen as a criterion due to the variation in number of ships operated and employees as shown in the sampling frame in Appendix A. Companies operating in shipping segments such as liner, bulk, tanker and general cargo operate different types of ships and compete in distinct markets (Stopford 2009). Companies limited to operations in Australia only may face different operating circumstances and threats than companies who, by virtue of trading internationally, have access to a more diverse range of markets. The following sections describe the findings based on this categorisation.

5.3.1 Company size

As explained in Chapter Four, data for shipping company size was obtained utilising two measures – number of ships operated (question F.3) and number of employees (question F.4). Based on the number of ships, shipping companies are categorised as small if they operate between one and nine ships, medium-sized if they operate between ten and 49 ships, and large if they operate 50 or more ships (Stopford 2009). Similarly, based upon the Australian Bureau of Statistics classification (ABS 2016), companies are categorised as small if they employ between 1 and 19 employees, medium-sized if they employ between 20 and 199 employees, and large if they employ 200 or more employees.

Based upon the number of ships operating in the company, data was collected from 11 small companies, six medium sized companies, and 13 large companies. These figures should be noted with the following two qualifications. First, where a company is owned by another shipping company and both are managed as one, the ship numbers of the two companies are combined. Second, in four cases the information provided by the

respondents was applicable to the Australian operations of the company only. In such cases, only the ships that are managed from Australia are counted to determine the size of the company.

Based on the number of employees, one company is categorised as a small company, seven as medium sized companies and 22 as large companies. Data for the number of ships and people employed by companies was obtained from individual companies' websites, the Company360 database, and in some cases the respondents themselves. Table 5-2 shows the number of companies categorised as small, medium and large based upon their number of employees and the number of ships operated.

Table 5-2: Number of small, medium and large companies

	Number based on ships	Number based on employees
Small	11 (36.67%)	1 (3.33%)
Medium	6 (20.00%)	7 (23.33%)
Large	13 (43.33%)	22 (73.33%)
Total	30 (100%)	30 (100%)

In this thesis, any reference to company size is based upon the number of ships by default. Where necessary, company size based on number of employees is acknowledged accordingly. This has been done for two reasons. First, during the interviews respondents invariably referred to their company as small or large with reference to the number of ships operated by the company. This indicates that people in the shipping industry associate company size with the number of ships operated by the company. Second, the number of employees in a company does not necessarily indicate the scale of company's operations. For example, one company operating less than 49 ships employs more than 2500 employees whereas another company operating over a hundred ships employs less

than 200 employees. The number of people employed by a company reflects the manner in which the company conducts its business. Some companies utilise associated companies and subsidiaries or agents whereas others perform all or part of their business functions in-house. Some companies outsource specific functions such as technical management to third parties. Similarly, some companies employ their own seafaring staff while others do not, or use a mix of own staff and marine crew supplied by third parties. Some shipping companies are also engaged in associated activities such as terminal operations. Hence, in most cases, stratification of company size based on number of ships operated provides a simpler, less complicated way to interpret data.

5.3.2 Types of ships and areas of operation

The types of ships operated by a company are an important characteristic of the company because they denote the shipping market segment(s) in which the company operates. A company that operates in two or more markets is more diversified than a company that operates in a single market. In this study, the ships are segmented as per the categories used in the UNCTAD Review of Maritime Transport (2015). UNCTAD's (2015) categorisation is considered appropriate for this study because UNCTAD uses this categorisation to analyse and report on developments in shipping. Table 5-3 illustrates the categories and their constituent ship types used in this study and Table 5-4 shows the number of companies operating ships belonging to particular ship categories.

The data shows that overall, the companies surveyed operate ships belonging to all five categories. Hence the survey captures diverse perspectives from senior managers who manage their companies in different markets. Table 5-4 shows that the sample contains companies that operate ships in all five categories thereby improving the generalisability of findings.

Table 5-3: Ship categories

Category	Constituent ship types
Oil tankers	Oil tankers
Bulk carriers	Bulk carriers, combination carriers
General cargo ships	Multi-purpose and project vessels, roll on/roll-off cargo, general cargo
Container ships	Fully cellular container ships
Other ships	Liquefied gas carriers, parcel (chemical) tankers, specialised tankers, reefers, offshore supply vessels, tugs, dredgers, cruise ships, ferries, other non-cargo carrying vessels

Source: Adapted from UNCTAD Review of Maritime Transport (2015, p. ix)

Sixteen companies (53.33 percent) operate a single category of ships while 14 companies (46.67 percent) operate two or more categories of ships. Hence, the total number of companies exceeds 30 in Table 5-4.

Table 5-4: Number of companies operating ships in different categories

Category	Number of companies
Oil tankers	6 (20.00%)
Bulk carriers	15 (50.00%)
General cargo ships	9 (30.00%)
Container ships	9 (30.00%)
Other ships	18 (60.00%)

The extent of diversification is also indicated by the geographical area in which a company's ships operate. In this study, eight respondents (26.67 percent) reported operating their ships in Australia, four respondents provided information applicable to their company's operation in Australia only (13.33 percent) and 18 respondents (60.00 percent) reported operating their ships in Australia as well as overseas. Hence, responses are obtained from a diverse range of perspectives which adds to the richness of data.

5.4 Respondent characteristics

As the unit of analysis in this study is the shipping company, it was essential that primary data was collected from respondents who occupied a senior position in their company so that they could provide information based on the whole of their organisation. All respondents in this study were asked to confirm their job title and role in their company. Table 5-5 shows the job titles/roles of the respondents. Many senior managers have unique job titles and to protect their identity, they are referred to as functional managers in Table 5-5. The category of functional managers includes senior managers responsible for functions such as the management of ship fleet, sales, human resources and commercial operations.

Table 5-5: Respondents' job title/role

Job title/role	Number of respondents	Percentage
Managing Director	10	33.33
Chief Executive Officer	4	13.33
General Manager	6	20.00
Functional Manager	9	30.00
Non-executive Director	1	3.33
Total	30	100.00

To simplify analysis, Managing Directors and Chief Executive Officers are grouped together and referred to as CEOs. The remaining senior managers are grouped together and referred to as Other Senior Managers (OSMs). Hence 46.67 percent of respondents are CEOs and 53.33 percent of respondents are OSMs in this study. Based upon their position and role within their company, all respondents are considered capable of providing quality data.

During their interview, all respondents were asked to state the length of time that they had worked for their current company. Respondents' length of employment in their present company ranges from four months to 43 years. The average length of respondents' employment in their current company is 14.6 years and the median is ten years. It is likely that the length of association with a company influences a respondent's knowledge about the company and its performance over time. Respondents' knowledge affects the quality of primary data collected (Kumar 2014). As shown in Table 5-6, 25 respondents, that is, 83.33 percent of respondents had worked for their current company for five years or more which suggests that they had knowledge of their company and its historical performance over a period of time.

Table 5-6: Respondents' length of employment in current company

Length of employment	Number of respondents	Percentage
< eleven months	2	6.67
1 – 4 years	3	10.00
5 – 9 years	9	30.00
10 – 19 years	4	13.33
20 – 29 years	8	26.67
30 years +	4	13.33
Total	30	100.00

The next section discusses the findings of respondents' experiences in managing disruptions.

5.5 Disruptions experienced by shipping companies

In order to partly answer SRQ1: *Which organisational capabilities contribute to the resilience of shipping companies?* respondents were asked to describe their experiences

in coping with any disruption faced by their company which threatened its viability. As mentioned in Chapter Four, questions A.5-A.16 of the Interview Questionnaire were designed to elicit the following information from respondents:

- Impact of any disruption on the company;
- Company's response to a disruption; and
- Lessons learnt from disruption.

The purpose of asking the respondents to describe their experiences of disruptions was to identify the organisational capabilities that contribute to withstanding disruptions. In other words, questions A.5-A.16 of the Interview Questionnaire were asked so that post-disruption capabilities that contribute to limiting the impact of disruptions were identified.

Out of the total 30 responses:

- 20.00 percent of respondents stated that they had experienced disruptions which had the potential to threaten their company's viability;
- 56.57 percent of respondents stated that they had not experienced any disruption that threatened the viability of their company; and
- 23.33 percent of respondents stated that they had experienced disruptions which, upon closer examination, were found to be of insufficient magnitude to threaten the viability of their company.

To avoid confusion, disruptions described by respondents as affecting the viability of their company are referred to as major disruptions in this chapter whereas disruptions not affecting the viability of the company are referred to as minor disruptions. In the sections that follow, the major disruptions are analysed followed by a discussion on the reporting of minor or no disruptions including the reasons why 23.33 percent of responses are not considered major disruptions.

5.5.1 Companies which experienced major disruptions

Table 5-7 shows the percentage of companies which experienced major disruptions, stratified by company size, category of ships operated and area of operation. In Table 5-7, figures in brackets indicate the number of companies. The first figure in the bracket indicates the number of companies from a particular strata which experienced a major disruption and the second figure (after the slash) indicates the total number of companies in that strata.

Table 5-7: Companies affected by major disruptions

Size of company:	**Small**	**Medium**	**Large**
	36.36% (4/11)	16.67% (1/6)	7.69% (1/3)
Category of ship:	**Single**	**Multiple**	
	25.00% (4/16)	14.29% (2/14)	
Area of operation:	**Australia**	**International**	
	41.67% (5/12)	5.56% (1/18)	

Table 5-7 shows that a greater proportion of small companies in the sample (36.36 percent) experienced disruptions than the proportion of medium-sized companies (16.67 percent) and large companies (7.69 percent). A greater proportion of single ship category operating companies (25.00 percent) experienced disruptions than the proportion of multiple category operating companies (14.29 percent). A greater proportion of companies operating in Australia (41.67 percent) experienced disruptions than the proportion of companies operating internationally (5.56 percent). While these figures suggest that small companies operating a single category of ship in Australia are more prone to disruptions, analysis below shows that it is modularity and response diversity

which influence the scale of impact that a disruptive event has on a company. As explained in Chapter Three, modularity refers to the manner in which a shipping company's ships, markets, facilities, people and technologies are linked to one another. A low level of modularity means that a relatively small impact of disruption may travel rapidly through tightly connected parts of the company, spreading the impact of the disruption. Similarly, as explained in Chapter Three, diversity refers to variety in the number of ships, markets, facilities, people and technology employed by a shipping company to conduct its business. Response diversity refers to the range of responses that are enabled by variety in the company. A high response diversity means that a company has more choices in the way it responds to a disruption. The following subsections analyse each of the six cases of disruption to reveal how modularity and response diversity influence the scale of impact of a disruption.

5.5.1.1 Major disruption Case One: Company #5

Company #5 is a small company providing a regular passenger and cargo service between two ports in Australia. The company operates ships of the same type and services a single market – the passenger and cargo trade between two ports. The company has low modularity because all its ships are engaged on the same route. Any disruption in shipping service has the potential to impact the whole company. The CEO of Company #5 revealed that in one instance, one of the two ports serviced by the company was closed due to flooding caused by heavy rains. As a result, the company was unable to disembark passengers and cargo destined for the closed port. In addition, a backlog of passengers and cargo was created as the company was forced to cancel its scheduled service for nearly a week. The company had in place a contingency plan which was based upon the use of an alternative berth in the port if the regular berth became unavailable. However, the planners had not anticipated the closure of the whole port which meant that options

were limited and the company had low response diversity. During the interview, CEO Company #5 stated that as a result of lessons learnt from the disruption, the company was in talks with the port authority of a nearby port to make infrastructure available for the company's ships at short notice if a similar event was to occur in future. The case highlights the limitations of contingency plans that are based upon assumptions about how unexpected events may unfold.

Company #5's experience contrasts with that of two other companies – Company #24 and Company #12 – whose respondents reported instances where their company was affected by floods. Unlike Company #5, the disruptions in these two companies were localised due to high modularity in the companies. Company #24 is a large company providing liner services worldwide utilising a fleet of more than 150 ships. The CEO of Company #24 described an event where large parts of a south-east Asian country were flooded. The flooded areas included industrial areas where the company's customers were located, hence the supply of cargo to the company's ships was affected. The company's local office facility was not affected however local staff could not reach the office premises due to flood affected transport links. The company activated its business continuity plan which required personnel from a nearby country to travel to the local office. However, the personnel were delayed in reaching the local office by the flood affected transport links as well.

Similar to Company #5, the planners in Company #24 had not anticipated such an eventuality. The CEO of Company #24 acknowledged the limitations of making assumptions by remarking that '*the lesson I learned is that you don't have one plan but two or three depending upon the scenario*'. The CEOs statement was an acknowledgement that the company's response diversity could be further improved. However, the CEO of Company #24 did not report this event as a disruption but rather as

an example of threats faced by the company. Notwithstanding the comments on improving planning by the CEO of Company #24, as discussed in Chapter Three there are limits to the extent that events can be anticipated and as a result, predetermined plans and procedures may yet be inadequate to cope with novelty (see, for example, Boin & van Eeten 2013; Leonard & Howitt 2012; McDaniel 2007). In the case of Company #24, it was due to high modularity that the company's business remained largely unaffected except for local operations in the flood affected country.

High modularity was also the reason why Company #12 did not face a major disruption in an instance where flood damage to railway lines disrupted the supply of cargo to one of its loading ports. Company #12 is a large company operating a fleet of 100 bulk carriers and general cargo ships worldwide. Due to its worldwide operations, disruption to the supply of cargo at one port did not have a significant impact on the company's overall business. The OSM of Company #12 remarked that the financial impact of the disruption would have been proportionally much greater '*say when the business started 25 years ago when we ran eight or nine ships*'. The cases of Company #12 and Company #24 illustrate how loss or damage is limited when different parts of the company operate largely independent of one another. This does not mean however that operating a large number of ships necessarily equates to higher modularity. As the following case illustrates, the manner in which shipping business is conducted can create tight links within different parts of the company such that a disruption in one part can cascade to other parts, thereby amplifying the impact of the disruption.

5.5.1.2 Major disruption Case Two: Company #23

Company #23 is a large company operating more than 500 ships worldwide. The company's fleet consists of container ships, bulk carriers, oil tankers, general cargo ships and other types of ships. The company's liner business employs approximately a fifth of

the company's fleet, placing it among the top 15 liner shipping companies in the world in terms of both TEU capacity and number of ships operated (Alphaliner 2017). In 2011, the country where the company's headquarters is situated experienced a major earthquake. The resulting tsunami caused widespread death, casualties, destruction and damage to buildings and infrastructure. Some port facilities were damaged and the authorities temporarily shut down all ports in the country. The CEO of Company #23 explained that the resulting port congestion seriously affected the company's ability to provide scheduled liner services. Customers were unable to receive and deliver cargo in and out of the country. Hinterland operations were similarly affected. The company's communication systems were also interrupted for a period of time. The CEO of Company #23 remarked that although the company had established emergency procedures in place, as a consequence of lessons learnt from the natural disaster, the company has set up an emergency communication system and established back-up persons for personnel performing critical roles, or in other words the company has attempted to improve its response diversity.

The impact of disruption caused by the earthquake and tsunami on Company #23 is in contrast to the impact on Company #15 which experienced the same event. Company #15 is one of the largest bulk carrier operating companies in the world. The OSM of Company #15 stated that as a consequence of the natural disaster, the company shifted office staff and their families from the affected area to another city for two months until the company was confident that it was safe for them to go back. Except for local operations, the impact on Company #15 was minor. The contrasting impacts on Company #23 and Company #15 are explained by the differences in modularity inherent in typical liner shipping and bulk carrier operations. For example, container ships on a particular trade route are tightly linked to other ships in the route and to the market in that trade. Liner ships provide a

fixed schedule service and several ships may be required to provide such service on a particular trade route. In case a port is closed and one of the ships is delayed by congestion, there is a cascading effect or '*snowball effect*' (CEO, Company #23) affecting all other ships of the line whose itinerary may have to be changed, affecting the shippers and consignees whose cargo is carried, or planned to be carried, by the ships. A bulk carrier operating in the tramp shipping sector on the other hand is loosely connected to the market and other ships of the company. For example, a bulk carrier may be performing a single voyage charter under a charter party with a single charterer. In case of a disruption, only the particular ship and the parties directly associated with the particular charter will be affected, unless the company has already fixed the ship for a subsequent charter in which case the next charterer will also be affected.

5.5.1.3 Major disruption Case Three: Company #4

Company #4 operates a small fleet of ships providing passenger/cargo ferry services and tourist cruises in Australia. The major portion of company's business arises from government contracts. At the time of interview, the OSM of Company #4 stated that the company was facing a major loss of business as the government's needs had changed. The respondent did not provide specific details, perhaps due to political sensitivities. The OSM of Company #4 described the situation as: '*governments sometimes make decisions that are political decisions and they cause a lot of grief to companies who rely on them to do the same thing on a regular basis*'. Due to the niche nature of its service and reliance on a single major customer for most of its business, Company #4 has low modularity. It also appears that the company cannot easily switch to new customers or markets and therefore has low response diversity. Hence any disruption to an existing business has a major impact.

5.5.1.3 Major disruption Case Four: Company #29

Company #29 operates a small fleet of ships engaged in energy trade in Australia. The company is fully owned by a large multinational energy company. The OSM of Company #29 reported an instance where a malicious attempt was made to penetrate the company's IT system. According to the respondent, the breach in the IT system could have potentially led to data loss and damage to communication capabilities necessitating suspension of shipping operations. Another major concern expressed by the respondent was the potential reputational damage to the global brand of the parent company. The respondent reported that the IT system vulnerability was subsequently identified and rectified, however it was not clear from the response if any alternative communication arrangements had been made in case of another breach. The respondent stated that '*having the system isolated as one of the defences is not an option*' (OSM, Company #29) which suggests that the company may have low response diversity to a similar incident. Furthermore, the reliance on IT systems creates a situation of low modularity because its performance affects the whole of the company.

In modern shipping companies, reliance on IT systems likely has a negative effect on modularity as illustrated by Case Four. However, low modularity does not necessarily preclude attempts by shipping companies to improve their response diversity. Case Two involving Company #23 discussed previously provides an example of attempts to improve response diversity. Following the major disruption mentioned in Case Two, the company established back-up systems and alternative arrangements which '*enable the staff to work from home and log into the IT systems remotely including the back-up servers*' should there be an IT disruption or cyber-attack (CEO, Company #23).

5.5.1.5 Major disruption Case Five: Company #3

Company #3 operates a small number of specialist ships to provide marine support services such as towage in Australia. The company relies on project based contracts to conduct its business. The CEO of Company #3 reported that the company has often faced disruptions to cash flow due to disputes arising with clients. When disputes arise, the company often has to settle for '*around 50 percent or 75 percent*' of the contracted sum of payment and the company is '*lucky to break even*' (CEO, Company #3). Since the sums involved with each project are large, any disruption to payment has potentially serious financial consequences for the company. The tight links between individual projects and the company's financial viability mean that the company has low modularity. However, the company appears to have high response diversity because, as reported by the CEO of Company #3, the company uses a variety of means to limit financial impact such as attempting to work with '*a better class of client*', inserting favourable terms and conditions in contracts, maintaining low debt level and taking out insurances.

5.5.1.6 Major disruption Case Six: Company #30

Company #30 is a medium sized company operating a fleet of support vessels for the offshore oil and gas industry in Australia. Due to its tight links with the Australian offshore industry, the company has low modularity which becomes evident from the statement by the OSM of Company #30 that since the contraction in offshore activity in Australia in 2014, the company has experienced a serious downturn in business. In response, the respondent stated that the company reduced its operating costs by laying up a few ships, reducing the number of crews on board ships and reducing the number of staff. The respondent further stated that the company is actively looking for new markets overseas. The company reaction to the disruption indicates a high level of diversity of response.

5.5.1.7 Summary of major disruptions

Table 5-8 contains a summary of the preceding discussion. Out of the six major disruptions reported, three were reported by CEOs (21.43 percent of all CEOs) and three were reported by OSMs (18.75 percent of all OSMs). Hence there does not appear to be any difference between CEOs and OSMs in how major disruptions are perceived. However, the preceding Cases Five and Six differ from Cases One to Four in one significant way. In Cases One to Four, the companies experienced a sudden disruption which affected their ability to utilise the resources needed to provide shipping services. The companies were forced to respond immediately to the disruption. The initial impact of the disruption was influenced by the extent of modularity and diversity present at the time of disruption. In Cases Five and Six however, the disruption was caused by market forces which do not appear to have required an urgent response from the companies. The high level of response diversity evident in Cases Five and Six may have evolved over a period of time due to adaptation by companies to changed circumstances. The organisational capabilities for adaptation are analysed in Chapter Six. Another point to note is that modularity and response diversity are contextual. A large company trading in multiple markets may display high levels modularity and response diversity if, for example, one of its ships was damaged in an accident. On the other hand, under different circumstances, the same company may exhibit lower levels of modularity and diversity if, for example, its IT system was compromised. Hence the importance of developing organisational capabilities that are independent of time and space such as learning ability, awareness and innovativeness remains. These capabilities are further explored by analysis of respondents' responses in Chapter Six.

Table 5-8: Major disruptions reported by respondents

Case	Company	Company characteristics			Cause of disruption	Impact on company	Factors contributing to scale of impact
		Size	Area of operation	Category of ships			
1	Company #5	Small	Australia	Single	Port closure due to flooding	Total disruption of shipping service	Low modularity, low response diversity
2	Company #23	Large	International	Multiple	Damage to port and hinterland infrastructure due to earthquake and tsunami	Major disruption to communication systems and liner service	Low modularity, low response diversity
3	Company #4	Small	Australia	Single	Withdrawal of major customer	Loss of business	Low modularity, low response diversity
4	Company #29	Small	Australia	Multiple	Malicious attempt to penetrate IT system	Potential suspension of operations and loss of data. Potential brand damage	Low modularity, low response diversity
5	Company #3	Small	Australia	Single	Payment disputes	Disruption to cash flow	Low modularity, high response diversity
6	Company #30	Medium	Australia	Single	Downturn in market	Loss of income and surplus capacity	Low modularity, high response diversity

5.5.2 Companies which experienced minor or no disruptions

As mentioned previously, 17 out of 30 respondents (56.57 percent) reported that they had not experienced a disruption in their present company. Out of these 17 respondents, 10 (58.82 percent) stated that they had previously experienced minor disruptions but did not provide specific details as they were not considered serious by the respondents. As was also mentioned previously, seven out of the total 30 respondents (23.33 percent) reported a minor disruption when asked about disruptions that threatened their company's viability. Table 5-9 summarises the descriptions of disruptions by these seven respondents. In the case of three large companies (Companies #1, #10 and #12) the reported disruptions were confined to single ships. In the case of another large company (Company #15), the company has offices worldwide and only one local office was affected by the natural disaster. In the case of one medium-sized company (Company #2), the disruption affected only one part of its portfolio of business activities. In the case of two small companies (Company #13 and Company #25) individual ships were associated with accidents, but none of the details provided by respondents indicated that their company's viability was threatened. Hence it is likely that these seven respondents may have misunderstood the question as being related to any disruption rather than a major disruption. In hindsight, greater emphasis could have been placed during the interview on stressing that only major disruptions needed describing.

Taken overall, 80.00 percent of the total number of respondents did not experience any serious disruption in their company. Only three respondents (10.00 percent of the total) who did not report any major or minor disruption had been in their present company for less than five years. Even the 20.00 percent of companies that had experienced major disruptions, were able to recover and maintain their functionality.

Table 5-9: Minor disruptions reported by respondents

Company	Company characteristics			Cause of disruption	Impact on company	Response	Factors limiting impact of disruption
	Size	Area of operation	Category of ships				
Company #1	Large	International	Multiple	Non-performance of chartered ship	Disruption to a particular service	Ship replaced	High modularity, high response diversity
Company #2	Medium	Australia	Multiple	Contraction of project	Early termination of contract	Future plans brought forward	High modularity, high response diversity
Company #10	Large	International	Single	Ship visit to a country under trade embargo	Supplier refusal to supply fuel	Fuel obtained from another port	High modularity, high response diversity
Company #12	Large	International	Multiple	Disruption of cargo supply in one port	Unable to carry cargo	Ship diverted to another port	High modularity, high response diversity
Company #13	Small	Australia	Single	Death of one crew member	Coronial enquiry	Restructure of on-board safety management	High modularity, high response diversity
Company #15	Large	International	Single	Natural disaster	Local office temporarily became uninhabitable	Office staff temporarily shifted to another city	High modularity, high response diversity
Company #25	Small	Australia	Multiple	Ship grounding	Negative media coverage	Ship re-floated and repaired	High modularity, high response diversity

Even though global shipping has been in serious economic downturn since the financial crisis of 2008 (ICS 2017), it appears that the vast majority of companies sampled have been resilient for at least the past five years. Chapter Six will explore the capabilities that may have contributed to the resilience of these shipping companies.

5.6 Summary

This chapter analysed the findings of the survey concerning respondents' experiences of actual disruptions faced by their companies. In order to contextualise findings, the chapter commenced with a discussion on response rates, followed by a description of the characteristics of shipping companies represented by the respondents, as well as the characteristics of the respondents themselves. The chapter focussed on identifying organisational capabilities that contribute towards the ability of companies to withstand disruptions. The experiences of respondents in managing actual disruptions reveal that disruptive situations may unfold in ways that have not been anticipated by planners. Modularity and response diversity influence the extent of impact from a disruption. The next chapter explores the capabilities that influence how companies avoid disruptions as well as activities that contribute towards developing capabilities for organisational resilience.

CHAPTER 6: SHIPPING COMPANIES' RESILIENCE CAPABILITIES

6.1 Introduction

This chapter is the second of two chapters that analyse and discuss the findings of this empirical study. The chapter commences with a discussion on the different types of threats of disruptions faced by shipping companies as reported by respondents. Next, the respondents' self-ratings of their company's effectiveness in reducing the likelihood of unexpected disruptions and their company's preparedness to withstand the impact of unexpected disruptions are analysed and discussed. The responses for Likert scale items are analysed and discussed to gauge the extent to which activities that contribute to the organisational capabilities of awareness, learning, innovativeness and robustness, as suggested by literature, occur in respondents' companies. The chapter ends with a discussion of the characterisation of resilience by senior managers.

6.2 Threats of disruptions

In order to partly answer SRQ1: *Which organisational capabilities contribute to the resilience of shipping companies?* and SRQ2: *How do senior managers of shipping companies develop their organisation's resilience capabilities?,* respondents were asked to describe their experiences in coping with any threat of unexpected disruption experienced by their company. As mentioned in Chapter Four, questions A.17-A.36 of the Interview Questionnaire were designed to elicit the following information from respondents:

- Company's response to any threat of disruption;
- Lessons learnt from any threat of disruption;
- Organisational changes made to cope with any threat of disruption; and
- Measures taken to reduce the likelihood as well as the impact of any potential disruption.

As this study is exploratory in nature, respondents were asked open-ended questions to describe their experiences of facing disruptive threats. Responses from senior managers reveal that shipping companies experience a variety of threats of unexpected disruptions that can be categorised as either market related or resource related. The viability of private companies is ultimately affected by financial considerations. Market related threats are those situations that can adversely affect companies' revenue and/or increase the cost of providing the shipping service. The threats to shipping companies arising from an operating environment that is characterised by uncertainty and volatility was outlined in Chapter One. Examples of threats provided by respondents through this chapter illustrate that market related threats to shipping companies arise from a variety of causes such as volatility in freight markets, collapse of markets, actions of competitors, unpredictability of stakeholders' expectations, and non-payment by customers for services rendered. Resource related threats can potentially deny shipping companies the use of their ships so that companies are unable to provide shipping services to their customers. Shipping companies rely on ships, port and hinterland infrastructure, people and technology to conduct their business. Any event that adversely affects the functioning of ships, infrastructure, people and technology, may lead to a disruption as further explained throughout this chapter. Examples provided by respondents illustrate that threats may arise from:

- Natural events such as cyclones, earthquakes, floods, tsunamis and pandemics that cause loss or damage to ships, infrastructure and technology, and harm people;
- Interruptions to services and goods provided by suppliers such as closure of ports and non-availability of bunkers;
- Accidents and casualties on-board ships that cause loss or damage to ships or loss of life;

- Institutional rules and regulations that determine how and where companies operate; and,
- Operational interferences such as port congestion, piracy, theft of cargo, IT breakdowns and machinery breakdowns.

All respondents reported experiencing threats of disruptions out of which, nine respondents (30.00 percent) reported market related threats, another nine respondents (30.00 percent) reported resource related threats and the remaining 12 respondents (40.00 percent) reported both market related and resource related threats. The significant percentage of respondents (30.00 percent) who did not mention any market related threat is significant given that the serious economic downturn in shipping since the global financial crisis of 2008 is widely reported (see, for example, ICS 2017; UNCTAD 2016) and confirmed by statements from respondents such as:

- *The shipping industry has been in a significant down cycle for the last number of years and it's a very cyclical industry (CEO, Company #6)*
- *The current situation we face in the market is pretty diabolical…relatively expensive high specification tonnage compared to what the market is prepared to pay is probably the biggest challenge we have faced in our existence…the market place is not able to cover the basic costs of shipping (OSM, Company #22)*
- *Too many boats chasing too little jobs (CEO, Company #3)*
- *Interesting times in business where shipping companies are going under and big groups are buying peer companies (OSM, Company #7)*

To investigate the types of threats reported by respondents further, data is stratified by the size of company, category of ships operated and area of operation as shown in Table 6-1.

Table 6-1: Threats reported by respondents

	Type of threat		
	Market related	**Market and resource related**	**Resource related**
Size of company:			
Small	27.27% (3/11)	27.27% (3/11)	45.45% (5/11)
Medium	50.00% (3/6)	50.00% (3/6)	
Large	23.08% (3/13)	46.15% (6/13)	30.77% (4/13)
Category of ship:			
Single	31.25% (5/16)	25.00% (4/16)	43.75% (7/16)
Multiple	28.57% (4/14)	57.14% (8/14)	14.29% (2/14)
Area of operation:			
Australia	33.33% (4/12)	25.00% (3/12)	41.67% (5/12)
International	27.78% (5/18)	50.00% (9/18)	22.22% (4/18)

In order to explore the relationship between companies who reported the three categories of threats – market related, resource related and both market and resource related – and company size, category of ship operated and area of operation; a chi-square test for independence was performed using IBM SPSS version 23. According to Pallant (2016), the chi-square test for independence enables the exploration of relationship between two categorical variables. Three separate tests were conducted to investigate any association between:

- Category of threat reported and size of company;
- Category of threat reported and category of ship operated; and
- Category of threat reported and area of operation.

The output from chi-square for independence revealed that in all three cases, more than 20 percent of expected frequencies are less than five. This violates the assumption of chi-

square that at least 80 percent of expected frequencies are more than five (Gray 2013; Lind, Marchal & Wathen 2015; Pallant 2016). Hence the chi-square test is not used. Nevertheless, information from the cross-tabulation table generated by chi-square (edited and reformatted for clarity and presented in Table 6-1) is useful for obtaining indications of possible associations between the categories in question.

Table 6-1 shows that a greater proportion of small companies (45.45 percent), companies operating single category of ship (43.75 percent) and companies limited to operations in Australia (41.67 percent) reported only resource related threats more than any other group of companies. These figures may be indicative of the high degree of seriousness attached to resource related disruptions by respondents from small companies operating a single category of ship in Australia. Small company size implies low modularity whereas operating in a limited market implies low response diversity.

Out of the nine companies that reported only resource related threats, one company which is the only one in the sample, is government owned and provides critical infrastructure. Government ownership of the company perhaps explains why the respondent from that company did not report any market related threat. Of the remaining eight companies, half of the respondents are CEOs and half are OSMs which suggests little difference in their perception of what constitutes a threat to the company. This point is further reinforced by findings from Chapter Five where the six cases of disruptions were reported by an equal number of CEOs and OSMs. To gauge the extent to which respondents are confident of their company's ability to cope with threats and disruptions, the following section discusses the respondents' self-rating of their company's ability for avoiding and withstanding disruptions.

6.3 Rating of companies' abilities

In question A.31 of the Interview Questionnaire, respondents were asked to rate their company's effectiveness in reducing the likelihood of unexpected disruptions on a scale of one to 10, where one is the least effective and 10 is the most effective. The rating scores provided by the respondents range between five and nine and the mean score of all responses is 7.57. Individual scores are shown in Appendix K. The high scores suggest that respondents are generally confident of their company's ability to avoid unexpected disruptions. The histogram of responses to question A.31 is shown in Figure 6-1.

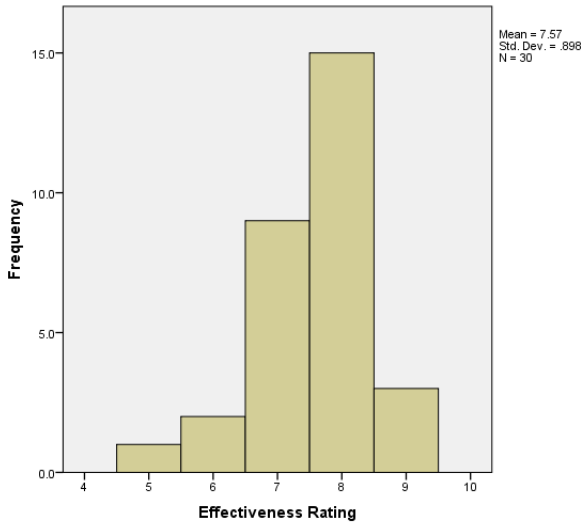


Figure 6-1: Histogram of respondents' self-rating of effectiveness

Source: Author

Inspection of the shape of the histogram indicates that the rating scores are not distributed normally. Ninety percent of scores are seven or higher and 60 percent of scores are eight or higher. Hence an assumption cannot be made that the population is normally distributed. As suggested by Gray (2013), Lind, Marchal and Wathen (2015) and Pallant (2016), non-parametric statistical techniques are utilised to analyse data because non-parametric techniques do not make assumptions about the normal distribution of

underlying population. Furthermore, non-parametric techniques are suitable when data is measured on nominal and ordinal scales and samples are small (Pallant 2016). Pallant (2016) further suggests two techniques for comparing groups – the Kruskal-Wallis test for comparing the scores of three or more groups and the Mann-Whitney U test for comparing the scores of two groups. In Chapter Five, shipping companies were initially grouped under three criteria based upon their size, category of ship operated and area of operation. Analysis of data in Chapter Five leads to a fourth criteria for grouping companies based upon whether they experienced a disruption or not. To investigate if there are differences in rating scores provided by respondents belonging to different groups of companies, the Kruskal-Wallis and Mann-Whitney U tests are utilised as shown in Table 6-2.

Table 6-2: Tests utilised to compare groups of companies

Question	Test	Coding
Is there a difference in rating scores for small, medium and large companies?	Kruskal-Wallis test	1 = small, 2 = medium, 3 = large
Is there a difference in rating scores for companies that operate a single category of ship and those that operate multiple categories of ships?	Mann-Whitney U test	1 = single category, 2 = multiple categories
Is there a difference in rating scores for companies who operate ships in Australia only and those that operate ships internationally?	Mann-Whitney U test	1 = Australia, 2 = international
Is there a difference in rating scores for companies that have experienced disruption and those that have not experienced disruption?	Mann-Whitney U test	1 = experienced disruption 2 = did not experience disruption

The outcomes of the Kruskal-Wallis test and Mann-Whitney U tests carried out using IBM SPSS version 23 show no statistically significant difference in rating scores between the groups of companies. For the difference to be statistically significant, output from a Kruskal-Wallis test or a Mann-Whitney U test should indicate a significance level (p-

value) of less than 0.05 (Pallant 2016). The significance levels indicated by the tests conducted are as follows:

- The Kruskal-Wallis test used for comparing different sized companies indicates a p-value of 0.741;
- The Mann-Whitney U test used for comparing companies that operate a single category of ship and companies that operate multiple categories of ships indicates a p-value of 0.257;
- The Mann-Whitney U test used for comparing companies that operate in Australia and companies that operate internationally indicates a p-value of 0.491; and,
- The Mann-Whitney U test used for comparing companies that have experienced disruptions and companies that have not experienced disruptions indicates a p-value of 1.000.

As the p-values are higher than 0.05 in all four tests above, no significant relationship is observed between the rating scores given by respondents and company characteristics such as size, category of ship operated, area of operation, and experience of disruption.

In question A.35 of the Interview Questionnaire, respondents were asked to rate their company's preparedness to withstand the impact of unexpected disruptions on a scale of one to 10, where one is the least effective and 10 is the most effective. The rating scores provided by the respondents range between five and nine and the mean score of all responses is 7.87. The high scores suggest that respondents are generally confident of their company's ability to withstand unexpected disruptions. The histogram of responses to question A.35 is shown in Figure 6-2.

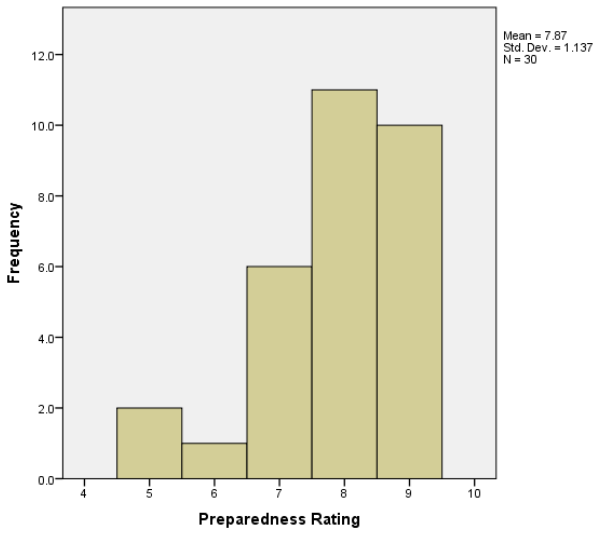


Figure 6-2: Histogram of respondents' self-rating of preparedness

Source: Author

The shape of histogram indicates that the rating scores are not distributed normally. To determine if there are differences in rating scores provided by respondents belonging to different groups of companies, the Kruskal-Wallis test and Mann-Whitney U test were utilised as explained previously in Table 6-2. The p-values indicated by the tests conducted are as follows:

- The Kruskal-Wallis test used for comparing different sized companies indicates a p-value of 0.469;
- The Mann-Whitney U test used for comparing companies that operate a single category of ship and companies that operate multiple categories of ships indicates a p-value of 0.918;
- the Mann-Whitney U test used for comparing companies that operate in Australia and companies that operate internationally indicates a p-value of 0.439; and
- the Mann-Whitney U test used for comparing companies that have experienced disruptions and companies that have not experienced disruptions indicates a p-value of 0.705.

As the p-values are higher than 0.05 in all four tests above, no significant relationship is observed between the rating scores given by respondents and company characteristics such as size, category of ship operated, area of operation, and experience of disruption. The confidence of senior managers in their companies' ability to successfully cope with threats and disruptions is further indicated by the reasons stated to justify the rating scores. The reasons provided for the ratings are discussed below.

6.3.1 Respondents' justification for ratings

Question A.32 of the Interview Questionnaire asked respondents to provide reasons for rating their company's effectiveness in reducing the likelihood of unexpected disruptions. As shown in Table 6-3, 10 respondents (33.33 percent) made statements outlining their view that it is not possible to foresee every eventuality. Comments made included statements such as '*things happen that we can't foresee*' (CEO, Company #1), '*cannot anticipate everything*' (OSM, Company #15), '*disruptions are inevitable*' (OSM, Company #17) and '*complete protection is not viable*' (CEO, Company #28). Such statements suggest that these 10 senior managers are confident that nothing more can be done to reduce the likelihood of disruptions in their company.

In contrast to the 10 respondents above, six respondents (20.00 percent) hold the view that more can be done to reduce the likelihood of unexpected disruptions with statements such as '*we are not perfect*' (CEO, Company #5) and '*there is always room for improvement*' (OSM, Company #25). However, all of these six respondents rated their company's ability to reduce the likelihood of disruptions above seven, which suggests that their statements may reflect a worldview rather than any specific shortcoming of their company.

Table 6-3: Respondents' reasons for effectiveness rating

Number	Reason	Statements
10 (33.33%)	More cannot be done	Things happen that we can't foresee (CEO, Company #1) Can't imagine every possibility (CEO, Company #2) You can't cover absolutely everything (CEO, Company #10) Difficult to prepare for unforeseen events (CEO, Company #20) Cannot mitigate every risk (CEO, Company #27) Complete protection is not viable (CEO, Company #28) You can't foresee everything (OSM, Company #11) Acts of God are difficult to plan for (OSM, Company #12) Cannot anticipate everything (OSM, Company #15) Disruptions are inevitable (OSM, Company #17)
6 (20.00%)	More can be done	We can always do better (CEO, Company #3) We are not perfect (CEO, Company #5) We can always improve (CEO, Company #18) We could do better (OSM, Company #4) There is always room for improvement (OSM, Company #19) Always room for improvement (OSM, Company #25)
6 (20.00%)	Activities making a positive contribution	We manage costs and revenue well (CEO, Company #6) We quantify risk and deal with it (CEO, Company #8) We have alternative plans (CEO, Company #24) We can anticipate market changes (OSM, Company #7) We do business risk assessments (OSM, Company #13) We take calculated risks (OSM, Company #14)
8 (26.67%)	Company characteristics making a positive contribution	Diversified markets, low debt (CEO, Company #26) Multiple customers, distributed fleet (OSM, Company #9) Diversified company (OSM, Company #21) Diversified, responsiveness, flat management (OSM, Company #22) Management experience, proactiveness (OSM, Company #16) Experienced risk management team (CEO, Company #23) Good procedures, trained staff (OSM, Company #30) Compliance with regulations (OSM, Company #29)
30 (100.00%)	Total	

The remaining 14 respondents (46.67 percent) provided examples of specific activities occurring in their companies, or specific company characteristics, that made a positive contribution to their company's effectiveness in reducing the likelihood of disruptions. Six respondents (20.00 percent) referred to actions taken in response to market related threats. These actions included managing '*costs and revenue well*' (CEO, Company #6) and taking '*calculated risks*' (OSM, Company #14). Eight respondents (26.67 percent)

identified company characteristics that made a positive contribution to their company's effectiveness in reducing the likelihood of disruptions. These include operating in '*diversified markets*' (CEO, Company #26), '*management experience*' (OSM, Company #16) and '*compliance with regulations*' (OSM, Company #29). Overall, the responses suggest confidence among senior managers of the sample that their companies are effective in reducing the likelihood of disruptions, despite one respondent giving her company a rating of five as indicated in Figure 6-1. The respondent who gave the score of five (OSM, Company #13) stated during the interview that a fatality had recently occurred on board a ship due to violation of safety procedures. According to OSM Company #5, the company was establishing new procedures but as the procedures were still being established at the time of interview, she did not rate the company higher.

Question A.36 of the Interview Questionnaire asked respondents to provide reasons for rating their company's preparedness to withstand the impact of unexpected disruptions. As shown in Table 6-4, half of all respondents (50.00 percent) consider pre-prepared plans and pre-established processes making a positive contribution to their company's preparedness. While planning is necessary to develop resilience capabilities (Lee, Vargo & Seville 2013), as illustrated by the cases of Company #5 and Company #23 in Chapter Five, plans have limitations because they are based upon assumptions (McDaniel 2007; Parsons 2010). When situations unfold in unanticipated ways, companies may have to rely on resilience capabilities rather than following pre-existing plans and procedures to maintain functionality. Hence, a fuller understanding of the resilience capabilities of shipping companies in the sample requires analysis of data obtained from Likert scale questions that are discussed in sections 6.4 – 6.7 later in this chapter.

Table 6-4: Respondents' reasons for preparedness rating

Number	Reason	Statements
15 (50.00%)	Plans and processes making a positive contribution	Alternative plans and insurance cover (CEO, Company #1) Contingency plans and insurance cover (CEO, Company #2) Good contingency plans in place (CEO, Company #5) We are well prepared for crisis management (CEO, Company #6) Standards and procedures in place (CEO, Company #10) Have good plans (CEO, Company #20) Plans based on risk assessment (CEO, Company #23) Business continuity plan (CEO, Company #24) Good contingency planning (OSM, Company #13) We have disaster plans (OSM, Company #14) Good risk management (OSM, Company #16) Good contingency management framework (OSM, Company #17) Have business continuity plan (OSM, Company #19) Good contingency planning (OSM, Company #25) Contingency procedures in place (OSM, Company #30)
8 (26.67%)	Company characteristics making a positive contribution	Good management, low debt (CEO, Company #3) Management expertise (OSM, Company #21) We are agile (CEO, Company #27) Good management, fast decision-making (OSM, Company #15) In-house control, less dependence on others (CEO, Company #26) Multiple customers, distributed fleet (OSM, Company #9) Diversity, large size (OSM, Company #11) Diversified, long term finance (OSM, Company #22)
4 (13.33%)	More cannot be done	We can't insure against everything (CEO, Company #8) Cannot envisage every possible event (CEO, Company #18) Complete protection is not viable (CEO, Company #28) Chance that we can be surprised (OSM, Company #12)
2 (06.67%)	More can be done	We could do better (OSM, Company #4) Things can be improved (OSM, Company #29)
1 (3.33%)	Company activities with negative impact	Ad-hoc decision-making, no real plan (OSM, Company #7)
30 (100.00%)	Total	

Similarities and overlaps can be observed in the responses contained in Tables 6-3 and 6-4. For both effectiveness in reducing the likelihood of disruption and preparedness for withstanding disruptions, five respondents gave similar reasons (OSM, Company #4; OSM, Company #9; OSM, Company #12; OSM, Company #22 and CEO, Company #28). In both cases, respondents suggested that either more could be done or nothing more could

be done to address effectiveness in reducing the likelihood of disruption and preparedness for withstanding disruptions in their company. The similarities and overlaps in response indicate the indistinct boundary between a threat, that is, likelihood of disruption and actual disruption as perceived by respondents. As the cases discussed previously in Chapter Five show, threats and disruptions are contextualised especially with respect to modularity and diversity.

Given that the vast majority of shipping companies sampled have been resilient for at least the past five years, the high rating scores are not unexpected. The measures taken by shipping companies in the sample in response to, and in anticipation of, threats and disruptions become prescriptions for developing resilience capabilities. The measures become prescriptions because they indicate the activities of companies that are resilient. These prescriptions are included in the analysis of Likert scale data in sections 6.4 – 6.7 that follow. Likert scale data is arranged under the headings of awareness, learning, innovativeness and robustness as per the conceptual frame discussed in Chapter Four utilised for this study. Kruskal-Wallis tests and Mann-Whitney U tests are carried out on all Likert scale items as per Table 6-2. Only those outputs are discussed whose p-value is less than 0.05.

6.4 Awareness

In order to adapt proactively and avoid disruptions, companies must be able to anticipate and recognise threats and opportunities created by changing situations (Friedman 2005; Hollnagel 2014; Madni & Jackson 2009). This requires people in companies to develop awareness of the situation (McManus 2008; Parsons 2010; Seville 2017). In order to make sense of the situation, people need to be aware of their company's strengths and weaknesses so that threats and opportunities can be contextualised to their own company.

Four respondents reported that awareness helped their company gain competitive advantage. According to the OSM of Company #4, '*in a competitive market [we] have to see what others are doing and then try to adapt*'. The CEO of Company #10 stated that '*we're having to be up to date with information, as it happens on a day to day basis as it can affect our trading…we are aware of things that are going on now*'. The OSM of Company #4 noted that in their company, senior managers, regional managers and regional operations managers are expected to '*look for opportunities…and potential problems that are floating around out there*' and bring that information back to the corporate level management. Similarly, the OSM of Company #22 stated that employees of the company '*were expected to be in touch with what's going on in the market*'. The CEO of Company #18 commented that their company utilised a specific process called '*external relations*' and as a result '*we stay very informed*'. The OSM of Company #22 provided an example whereby the company was advised by people '*with a great deal of experience*' to time charter ships for long periods '*simply because they had never seen the market so low*'. The company rejected the advice and its decision was justified later when the charter rates fell even further over the next three years (OSM, Company #22). According to the OSM of Company #22 '*we were aware, and we are aware, of what the market is doing all the time as an organisation*'.

As discussed in Chapter Three, awareness comprises of two dimensions – social capital and networking. The following subsections analyse the responses to each of these two dimensions.

6.4.1 Social capital

As discussed in Chapter Three, the indicators of social capital are interaction and collaboration between employees and employee knowledge of organisation. Table 6-5

shows the average response for each item related to interaction and collaboration among employees together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-5: Interaction and collaboration among employees

Interaction and collaboration among employees:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
B.5	New staff are mentored	4.03	0.76	0	0	2	2	19	7	30	86.7%
B.6	Staff are regularly rotated around different sections of	3.20	1.10	0	1	10	3	14	2	30	53.3%
B.7	Staff meetings are held across different sections of company	4.30	0.92	0	0	3	0	12	15	30	90%
B.8	Opportunities are provided for staff to collaborate with each other	4.60	0.56	0	0	0	1	10	19	30	96.7%
B.14	Staff are rewarded for reporting threats to the company	3.47	1.36	0	0	5	4	13	6	28	63.3%
B.15	Staff are rewarded for reporting opportunities for the company	3.90	0.92	0	0	3	5	14	8	30	73.3%
B.16	Staff are rewarded for reporting disruptions	3.73	0.98	0	0	5	4	15	6	30	70.0%

The highest percentage of agreement, 96.7 percent, was with item B.8 '*opportunities are provided for staff to collaborate with each other*' followed by 90.0 percent agreement with item B.7 '*staff meetings are held across different sections of the company*', 86.7 percent of agreement with item B.5 '*new staff are mentored*', and a relatively low level of agreement, 53.3 percent, with item B.6 '*staff are regularly rotated around different sections of company*'.

The Mann-Whitney U test for item B.6 revealed significant difference (p-value = 0.025) in the distribution of responses between companies operating single and multiple categories of ships. The average score for companies operating a single category of ship was 2.75, which is lower than the average score of 3.71 for companies operating multiple categories of ship. The proportion of respondents from companies operating a single category of ship who disagreed or were unsure of statement B.6 was 68.75 percent. In contrast, a smaller proportion of respondents from companies operating multiple categories of ships (21.43 percent) disagreed or were unsure of statement B.6. This

suggests that single ship operating companies may not have the need to rotate staff among different sections as they are less likely to have multiple sections in the company as compared to companies operating multiple categories of ships. The relatively low level of agreement with item B.6 also suggests that since senior managers are satisfied with the intra-company interactions occurring through collaboration and meetings, they may consider rotating staff around different sections less important. In some cases, it may not be feasible to rotate employees due to the specialist or technical nature of their work. In the case of companies that operate from geographically dispersed locations, an undesirable consequence of moving employees may be the negative impact on relationships that are built between local staff and local stakeholders.

Statements in items B.14, B.15 and B.16 were designed to find out if companies provide incentives to their staff for reporting opportunities, threats and disruptions. Among these statements, the highest level of agreement, 73.3 percent was with item B.15 '*staff are rewarded for reporting opportunities for the company*', followed by 70.0 percent agreement with item B.16 '*staff are rewarded for reporting disruptions*', and 63.3 percent agreement with item B.14 '*staff are rewarded for reporting threats to their company*'.

The Mann-Whitney U test for item B.16 revealed significant difference (p-value = 0.033) in the distribution of responses between companies that had experienced disruption and those that had not experienced disruption. The average score for companies that had experienced disruption is 4.5 which is higher than the average score of 3.69 for companies that had not experienced disruption. None of the respondents from the group of companies that had experienced disruption disagreed with item B.16 in contrast to the group of companies that had not experienced disruption where 37.50 percent of respondents disagreed or were unsure of item B.16. Respondents who disagreed or were unsure of item B.16 commonly commented that in their companies, staff were expected to report

disruptions as part of their routine job role and no special incentives were provided. It is unclear whether the high scale of agreement with item B.16 by respondents from companies that had experienced disruptions is a consequence of lessons learnt from disruptions or there is some other explanation.

Table 6-6 shows the average response for each item related to employee knowledge of organisation together with the frequency of responses against each level of agreement in the Likert scale. Specifically, with respect to employees' understanding of the roles and responsibilities within their company, 96.7 percent of respondents agreed or strongly agreed with item B.1 statement '*staff roles and responsibilities are clearly defined*' and 90.0 percent agreed or strongly agreed with item B.2 statement '*managers' roles and responsibility are clearly defined*'.

Table 6-6: Employee knowledge of organisation

Employee knowledge of organisation:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
B.1	Staff roles and responsibilities are clearly defined	4.53	0.68	0	0	1	0	11	18	30	96.7%
B.2	Managers' roles and responsibilities are clearly defined	4.43	0.94	0	0	3	0	8	19	30	90.0%
B.3	Managers keep staff updated on company's key performance indicators or KPIs	4.03	0.89	0	0	3	2	16	9	30	83.3%
B.4	Staff performance appraisals are linked to the achievement of strategic objectives	3.87	0.97	0	0	4	4	14	8	30	73.3%
B.20	Stakeholders' feedback is shared with staff	3.83	0.91	0	0	4	3	17	6	30	76.7%

The Mann-Whitney U test for item B.2 revealed significant difference (p-value = 0.007) in the distribution of responses between companies operating single and multiple categories of ship. The average score for companies operating a single category of ships was 4.00, which is lower than the average score of 4.93 for companies operating multiple categories of ships. Further investigation revealed that three respondents from the group of companies operating a single category of ship disagreed with item B.2 in contrast to the group of companies operating multiple categories of ships where all respondents

agreed or strongly agreed with item B.2. The first respondent who disagreed with item B.2 is the CEO of a medium sized bulk carrier operating company, with more than 30 years' experience in that company. The company is a family owned business, which suggests that the managers' roles may not have been formally defined. The second respondent is the CEO of a small bulk carrier operating company, with more than 20 years' experience in that company. Bulk carrier operating companies typically have a small number of staff (Stopford 2009) which may be the reason why managers' roles in this company are not clearly defined. The third respondent is the OSM of a small bulk carrier operating company, with more than 10 years' experience in that company. The OSM remarked that the company had recently acquired new business responsibilities, which, together with the small size of the company, may be the reason why managers' roles are not clearly defined. None of the three respondents reported experiencing disruption in their company.

Employees' awareness of their company's strengths and weaknesses is enhanced by knowing how their company is performing. Eighty-three point three percent of respondents agreed with the statement in item B.3 '*managers keep staff updated on company's key performance indicators*', 76.7 percent agreed with item B.20 '*stakeholders' feedback is shared with staff*' and 73.3 percent agreed with item B.4 '*staff performance appraisals are linked to the achievement of strategic objectives*'. One respondent who disagreed with item B.20 stated that feedback from stakeholders was shared among managers but not with other staff. Another respondent mentioned that he was unsure of item B.4 because he only supervised a handful of staff directly.

Internal communication relating to a company's performance helps to convey senior management's expectations to staff and raises staff's awareness of how their company is situated in the market. One respondent explained how the top-down and bottom-up

communication about company's performance occurs in a transparent manner within their company:

> *...we have reporting mechanisms that allow us to not only report on the financial stability of the areas and regions that we operate in but we also have top-down reporting mechanisms that come down to us in terms of what the overall performance of the company is, as a whole globally, and then breaks it down into regions and areas…we have tremendous transparency in terms of what we do…how we audit from both an internal and external perspective and also as far as how we report on our core management cost numbers which happens on a weekly basis and updated on a quarterly basis (CEO, Company #06).*

The above example illustrates how internal communication can help in making people working in a particular business unit of a company aware of not just their company's overall performance, but also the performance of other business units. Such communication may assist in breaking down organisational silos by enabling people to see how their and other business units' performances contribute to the overall company performance. Breaking down silos, for example, increases collaboration within companies (Lagadec 1997; Seville, Van Opstal & Vargo 2015). Transparent dissemination of information relating to company performance including findings from internal audits and audits by external bodies helps towards internal discussions and debates based on facts rather than opinions.

6.4.2 Networking

As discussed in Chapter Three, the indicators of networking are business environment awareness and stakeholders' expectations awareness. Table 6-7 shows the average response for each item related to business environment awareness together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-7: Business environment awareness

Business environment awareness:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
B.9	Staff attend industry conferences	3.70	1.12	0	0	7	3	12	8	30	66.7%
B.10	Staff attend meetings with industry groups	3.80	1.00	0	0	5	3	15	7	30	73.3%
B.11	Staff are given access to key information sources	4.50	0.51	0	0	0	0	15	15	30	100.0%
B.12	Staff know who the customers are	4.60	0.97	0	0	0	0	8	22	30	100.0%
B.13	Staff know who the suppliers are	4.17	1.09	1	0	2	1	13	13	30	86.7%
B.17	The company is benchmarked against other companies	3.73	1.36	2	0	3	3	13	9	30	73.3%

With respect to business environment awareness, 100.0 percent of respondents agreed with the statement in item B.11 '*staff are given access to key information sources*', and item B.12 '*staff know who the customers are*'. These high levels of agreement indicate the importance shipping companies attach to raising market awareness among staff and maintaining customer relationships. A slightly lesser 86.7 percent of respondents agreed with the statement in item B.13 '*staff know who the suppliers are*'. With respect to the remaining items, 73.3 percent of respondents agreed with item B.17 '*the company is benchmarked against other companies*', the same percentage 73.3 percent agreed with item B.10 '*staff attend meetings with industry groups*', and a lower 66.7 percent agreed with item B.9 '*staff attend industry conferences*'. One respondent remarked that few staff attended industry conferences because participation in them was expensive. CEO Company #3 stated that it was difficult to benchmark against other companies because '*we are unique*'.

Awareness of the business environment is a necessary prerequisite for making informed business decisions. In this study, seven respondents (23.33 percent) reported how they employed a risk based approach to taking business decisions. The desirability of a risk based approach for decision-making by senior managers suggests motivation to anticipate and foresee problems that may arise in future, thus reducing the unexpectedness of threats and disruptions. The quality of decision-making is affected by awareness because risk

can only be assessed on the basis of what is known. A statement by the OSM of Company #11 that '*nobody has the answer to everything…you can't prepare for the unknown and you can only prepare for what you think may happen*' suggests that efforts to mitigate risk are dependent on senior manager's ability to foresee problems which in turn is based upon awareness of the situation.

Threats and disruptions may yet occur in unexpected ways, but risk assessment and mitigation is likely to reduce the number of disruptions that arise unexpectedly. In the words of the CEO of Company #2 '*a risk based approach reduces the likelihood of disruptions*'. As another respondent explained:

> *…the main part of our job…is to make sure whatever decisions we're making have the least risk associated with them. So an unexpected interruption, or problem, generally shouldn't come up, and normally wouldn't affect the company as a whole (OSM, Company #15).*

The purpose of a risk based approach to decision making is to identify and avoid situations that are seen as presenting unacceptable risks. According to the OSM of Company #25, the fundamental question for their company's managers is '*what type of situations we can get involved in, and are we prepared for these situations...and how?*'. The CEO of Company #1 had a similar comment, stating that '*we do not play the market…don't go chasing contracts even if they are there*'. Another respondent gave example of the type of situation their company avoids:

> *...when we take commercial decisions we look at the business and weigh up the pros and cons. And if we feel that it is, let's say, too difficult business... I don't mean that in terms of difficult for us to manage but, for example, let's say, coastal shipping [in Australia]. We would be very, very hesitant to get involved with coastal shipping at the moment due to the political and union problems that we might face putting our ships on the coast and the uncertainty (CEO, Company #8).*

In dealing with business risk, the CEO of Company #8 further commented that '*we have a system in place whereby we can, let's say, quantify the risk and deal with it*'. Another respondent noted that:

> *…when looking at business risks…we will do an assessment of the various risks, potential disruptions and what are the types of counter measures that we need to put in place to minimise the impacts of those potential disruptions (OSM, Company #19).*

Table 6-8 shows the average response for each item related to stakeholders' expectation awareness together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-8: Stakeholders' expectation awareness

Stakeholders' expectation awareness:					Frequency						Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
B.18	Feedback is obtained from customers	4.30	1.06	1	0	1	0	13	15	30	93.3%
B.19	Feedback is obtained from suppliers	3.30	1.42	3	0	4	5	14	4	30	60.0%

Regarding stakeholders' expectation awareness, 93.3 percent of respondents agreed with the statement in item B.18 '*feedback is obtained from customers*' reflecting the customer focus of shipping companies identified previously. A relatively less number of respondents, 60.0 percent, agreed with item B.19 '*feedback is obtained from suppliers*'. This suggests that some shipping companies may have purely transactional relationships with suppliers. This is understandable in the case of tramp shipping where due to the ad-hoc nature of ships' employment, companies may not know which suppliers, such as bunker suppliers, may be needed on a particular voyage until a fixture is agreed with charterers. All 'not applicable' responses in networking items (both Tables 6-7 and 6-8) were from companies operating tramp ships.

Insufficient knowledge about suppliers' capabilities can cause problems as illustrated by the example of Company #1 that was briefly mentioned in Chapter Five. The CEO of Company #1 described a case where the company was under a contract with government to provide a specific shipping service subsidised by the government. The shipping company contracted a ship and its crew from another company under a time charter for this purpose. The ship's performance did not meet the standards as per the time charter and there was a lengthy disruption to the service. The disruption to service necessitated meetings between the company and high-level government officials and other stakeholders to explain the situation. The company had to scour its network of industry contacts to source another ship. As a consequence of lessons learnt, the company decided that in future it would only operate its own ships with its own crew. It also decided to exercise greater auditing of third parties and to not rely solely on their reputation.

Company #1's case highlights the importance of communication with customers and other stakeholders. The case also illustrates the value of maintaining network contacts which enabled the company to source an alternative ship in this instance. Due diligence must be exercised when outsourcing services because as the case shows, supplier performance affects company's own performance and relationships with stakeholders.

Awareness of customer expectations is a prerequisite to satisfying customer needs and maintaining revenue flow. The CEO of Company #20 mentioned that there are instances when a customer's expectations are not foreseen and the company finds itself unable to satisfy the customer's needs. Effective communication is essential for understanding customer expectations. Knowing who to talk to, understanding others' needs and expectations, and conveying their own situation to them can all help in maintaining clarity in relationships. The OSM of Company #4, whose case was discussed in Chapter Five, explained how the company managed difficult relationships through communication:

> *…we have to have better relationships with both sides of the government… It's a difficult thing to have good relations with the government all the time because they tend to get voted out every now and again and then you have to start again…it's about relationships with all the stakeholders, and that goes from government through to public opinion groups. It's actually trying to find out what drives their decisions…making sure that the people who you need to talk to, you're talking to. And they understand what's going on (OSM, Company #4).*

Similarly, another respondent emphasised that important stakeholders needed to understand what impact their actions were likely to have on a shipping company's operation. The respondent remarked that where stakeholders such as local councils and road authorities had control over infrastructure such as wharves and access roads, it was important to establish working relationships:

> *…the main thing for us is to make sure that we're in the loop…and that's maintaining relationships with the key people involved…because you really need for them to know the impact on our operation, because if they don't, things could move quite quickly in the wrong direction and we know nothing about it. So the main learning for us is just to make sure that we're always maintaining relationships with the people who manage those assets (CEO, Company #27).*

Regulators and other authorities are important stakeholders in shipping. The case of Company #10 that was briefly mentioned in Chapter Five highlights the necessity of being aware of regulatory requirements that often change rapidly. The CEO of Company #10 described a situation where the company's ship visited a port located in a country against whom another country had placed a trade embargo. At the next port, fuel supply companies belonging to the country that had placed the embargo refused to supply the ship. The CEO of Company #18 provided another example where most unexpected issues for the company arose due to regulatory changes by the governments of the geographical area that the company's ships traded in. As described by the respondent:

> *…they [governments] throw a curve ball at you sometimes. Some of the government related decisions impact on our business when governments in our trading zones change their mind on certain regulatory frameworks. And we have to change our way of doing things as a result (CEO, Company #18).*

The CEO of Company #18 further stated how the company managed its relationship with the governments in their trading area:

> *...we have an open, regular dialogue with governments in most of the [area] where we operate. And we do that by keeping them abreast of our business. So we have a very pro-active approach to keeping them up to date with what's going on in our part, in our business. And how we deliver our service into the areas (CEO, Company #18).*

In summary, shipping companies can reduce the likelihood of unexpected threats and disruptions arising from the actions of customers and stakeholders by maintaining good relationships and effective communication so that customers' and stakeholders' actions do not come as a surprise. Awareness of customers' needs and expectations and maintaining good relationships with customers helps to sustain business with them even in difficult times (Shin & Thai 2015).

6.5 Learning

When people face unfamiliar situations, reliance on existing knowledge and procedures may be inadequate to cope with the elements of uncertainty and surprise (Friedman 2005; Uhl-Bien, Marion & McKelvey 2007). Survival and growth of a company in a complex environment may depend upon continuous learning and the successful generation and use of new knowledge by its people (Darnhofer, Fairweather & Moller 2010). As discussed in Chapter Three, both the creation of a learning culture in the company that supports discovery of new knowledge to solve problems, and the establishment of knowledge creation processes, were identified as dimensions of learning. The following sections analyse the responses to each of the two dimensions.

6.5.1 Learning culture

As discussed in Chapter Three, there are two indicators of learning culture – freedom of expression and learning capability development. Table 6-9 shows the average response

for each item related to learning culture together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-9: Freedom of expression

Freedom of expression:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
C.1	Staff are encouraged to talk about problems at work without fear of retribution	4.43	0.68	0	0	1	0	14	15	30	96.7%
C.2	Diversity of opinions is encouraged	4.50	0.57	0	0	0	1	13	16	30	96.7%
C.5	Staff can exchange information freely within the company	4.43	0.77	0	0	1	2	10	17	30	90.0%

The highest level of agreement, 96.7 percent, was with statements in item C.1 '*staff are encouraged to talk about problems at work without fear of retribution*' and item C.2 '*diversity of opinions is encouraged*', followed by 90.0 percent agreement with item C.5 '*staff can exchange information freely within the company*'. This suggests that in general, shipping companies create a safe environment for employees to express and share their opinions. Freedom of expression enables pertinent information to surface which helps in discovering new knowledge (Garvin, Edmondson & Gino 2008; McKenzie 2014; Pearson & Mitroff 1993).

Table 6-10 shows the average response for each item related to learning capability development together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-10: Learning capability development

Learning capability development:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
C.3	Staff are made aware of the limitations of company contingency plans	3.10	1.16	1	1	8	5	14	1	30	50.0%
C.4	Staff are made aware of the limitations of company risk assessment documents	3.37	1.10	0	0	11	0	16	3	30	63.3%
C.6	Staff are rewarded for sharing new knowledge	3.73	0.94	0	0	6	3	16	5	30	70.0%
C.7	New knowledge is disseminated widely in the company	4.07	0.87	0	0	3	1	17	9	30	86.7%
C.11	Staff selection criteria includes the ability to learn	3.93	0.83	0	0	3	1	20	6	30	86.7%
C.12	Staff development activities target learning skills	3.93	0.91	0	0	4	1	18	7	30	83.3%

The highest level of agreement, 86.7 percent, was with statements in item C.7 '*new knowledge is disseminated widely in the company*' and item C.11 '*staff selection criteria includes the ability to learn*' followed by 83.3 percent for item C.12 '*staff development activities target learning skills*' and 70.0 percent for item C.6 '*staff are rewarded for sharing new knowledge*'. The high percentage of agreement with the preceding four items indicates that overall shipping companies support the creation and dissemination of new knowledge. However, there is much less support for questioning of assumptions that underpin plans as indicated by the lower level of agreement (50.0 percent) with item C.3 '*staff are made aware of the limitations of company contingency plans*' and item C.4 '*staff are made aware of the limitations of company risk assessment documents*' (63.3 percent).

The Mann-Whitney U tests for items C.3 and C.4 revealed significant differences (p-value = 0.038 and p-value = 0.025 respectively) in the distribution of responses between companies that had experienced disruption and those that had not experienced disruption. For item C.3, the average score for companies that had experienced disruption is 4.00 which is higher than the average score of 3.07 for companies that had not experienced disruption. Similarly, for item C.4, the average score for companies that had experienced disruption is 4.33, which is higher than the average score of 3.31 for companies that had not experienced disruption. In both cases, the differences result from the high percentage of respondents from companies that had not experienced disruption who either disagreed, or were unsure, or responded 'not applicable' to the two items (62.55 percent for item C.3 and 45.83 percent for item C.4). It is unclear whether the high scale of agreement with items C.3 and C.4 by respondents from companies that had experienced disruptions is a consequence of lessons learnt from disruptions or there is some other explanation. Overall, across the sample however, the responses to items C.3 and C.4 suggest that

questioning of assumptions is not widely practised in shipping companies. It also suggests that while information flows freely within companies from lower hierarchical levels to senior management – as indicated by the responses to items C.1, C.2 and C.5 – the reverse may not always be true with respect to contingency and risk planning.

6.5.2 Knowledge creation processes

As discussed in Chapter Three, there are three indicators of knowledge creation processes – scenario simulations, learning from failures and decision-making training. Table 6-11 shows the average response for each item related to scenario simulations together with the frequency of responses against each level of agreement in the Likert scale. The responses show that staff participation in scenario simulations is much less (53.3 percent) than managers (73.3 percent). This indicates that shipping companies may not be fully utilising the capabilities of their staff in testing and validating plans. In addition, staff may not be fully prepared to cope with unexpected situations and may thus make limited contribution to their company's resilience.

Table 6-11: Scenario simulations

Scenario simulations:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
C.8	Staff participate in exercises involving 'what if' scenarios	3.27	1.14	0	0	12	2	12	4	30	53.3%
C.9	Managers participate in exercises involving 'what if' scenarios	3.70	1.12	0	0	8	0	15	7	30	73.3%

The Mann-Whitney U tests for item C.8 revealed significant differences in the distribution of responses between companies that operate ships in Australia only and companies that operate internationally (p-value = 0.002). Significant differences are also observed between companies that had experienced disruption and those that had not experienced disruption (p-value = 0.044). With respect to the area of operation, the average score for companies operating ships in Australia only is 4.08, which is higher

than the average score of 2.72 for companies operating ships internationally. The differences in average scores arises because a greater percentage of respondents from companies operating ships internationally (72.22 percent) were in disagreement with, or responded 'not applicable' to item C.8 as compared to only one respondent (8.33 percent) from companies operating only in Australia who disagreed. It is plausible that companies operating ships internationally may find it less practical to arrange scenario simulations with geographically dispersed staff than companies whose staff are all located in Australia.

For item C.8, the average score for companies that had experienced disruption is 4.17, which is higher than the average score of 3.28 for companies that had not experienced disruption. The difference results from the high percentage of respondents from companies that had not experienced disruption who either disagreed or were unsure about item C.8 (54.17 percent) as compared to only one respondent (16.67 percent) who was unsure from among the companies that had experienced disruption. It is unclear whether the higher level of agreement with items C.8 by respondents from companies that had experienced disruptions is a consequence of lessons learnt from disruptions or there is some other explanation.

For item C.8, the Kruskal-Wallis test for comparing different sized companies gave a p-value of 0.032. The average scores across small, medium and large companies were 3.91, 3.33 and 2.69 respectively. The percentage of respondents who either disagreed or were unsure about item C.8 was 18.18 percent for small companies, 33.33 percent for medium sized companies and 69.23 percent for large companies. Hence proportionally, there is greater participation of staff in scenario simulations in small companies than larger companies. A possible explanation for this difference is that some large companies may have greater bureaucracy than some smaller companies, which may result in greater

hierarchical distance between say, frontline staff and senior managers. However, a caveat needs to be added that no data about organisational structures of companies in the sample was available for this study.

The Mann-Whitney U test for item C.9 also revealed significant differences in the distribution of responses between companies who operate ships in Australia only and companies that operate internationally (p-value = 0.035). The average score for companies operating ships in Australia only is 4.33, which is higher than the average score of 3.28 for companies operating ships internationally. The differences in average scores arises because 44.44 percent of respondents from companies operating ships internationally were in disagreement with item C.9 as compared to none from companies operating only in Australia. Similar to the explanation provided for item C.8, it is plausible that some companies operating ships internationally may find it less practical to arrange scenario simulations with geographically dispersed managers than companies whose managers are all located in Australia.

Table 6-12 shows the average response for each item related to learning from failures together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-12: Learning from failures

Learning from failures:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
C.13	Processes exist for systematic review of past failures	3.83	1.02	0	0	5	3	14	8	30	73.3%
C.14	Lessons from past failures are made accessible to staff	3.57	1.04	0	0	6	7	11	6	30	56.7%
C.15	Continuous improvement processes are utilised to build up knowledge	4.20	0.92	0	0	3	1	13	13	30	86.7%

The high level of agreement with item C.15 '*continuous improvement processes are utilised to build up knowledge*' (86.7 percent) and item C.13 '*processes exist for*

systematic review of past failures' (73.3 percent), when considered together with item C.7 from Table 6-10, indicates that overall, shipping companies systematically review, record and disseminate knowledge within their company. However, information related to failures is not widely shared with staff as indicated by the low level of agreement (56.7 percent) with item C.14 '*lessons from past failures are made accessible to staff*'. As Lagadec (1997) asserts, failure is not readily acknowledged within companies.

Table 6-13 shows the average response to the item related to decision-making training together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-13: Decision-making training

Decision-making training:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
C.10	Managers are trained in decision-making techniques under uncertain circumstances	3.00	1.08	0	1	13	2	13	1	30	46.7%

The lowest level of agreement among the knowledge creation processes items – 46.7 percent – was with the statement in item C.10 '*managers are trained in decision making techniques under uncertain circumstances*'. Since the respondents occupy positions of authority, it may be assumed that they are able to put measures in place to address issues of concern. The response to item C.10 suggests that a slight majority of respondents do not consider it necessary for training to be provided to managers in specialist decision-making techniques. Since shipping companies operate in a dynamic, highly competitive and unpredictable environment, some respondents may have considered managing uncertain situations a routine activity for which no specialist training need be provided.

The Mann-Whitney U tests for item C.10 revealed significant differences between companies that had experienced disruption and those that had not experienced disruption

(p-value = 0.005). The average score for companies that had experienced disruption is 4.17 which is higher than the average score of 2.97 for companies that had not experienced disruption. The different results from the 66.67 percent of respondents from companies that had not experienced disruption who either disagreed or were unsure about item C.10 as compared to none from among the companies that had experienced disruption. It is unclear whether the higher level of agreement with item C.10 by respondents from companies that had experienced disruptions is a consequence of lessons learnt from disruptions or there is some other explanation.

6.6 Innovativeness

The need for innovation arises for the same reasons as the need for awareness and learning – actual conditions often do not match the assumptions on which plans and procedures are based to cope with unexpected situations (Hollnagel 2014; Jansen, Cammock & Conner 2011). In addition, companies may need to find innovative ways to exploit opportunities presented by unexpected situations (Välikangas 2010). As discussed in Chapter Three, there are two dimensions of innovativeness – staff empowerment and supportive leadership. The following sub-sections discuss the responses to each of the two dimensions.

6.6.1 Staff empowerment

As discussed in Chapter Three, there are two indicators of staff empowerment – delegation and staff competency development. Table 6-14 shows the average response for each item related to delegation together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-14: Delegation

Delegation:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
D.4	Senior managers do not provide detailed work instructions	3.43	1.10	0	0	10	11	15	4	40	47.5%
D.6	Senior managers do not enforce strict adherence to company procedures	2.17	0.95	0	6	18	1	5	0	30	16.7%
D.8	Strategic plans are made in consultation with staff	3.40	1.25	0	1	10	1	12	6	30	60.0%

The lowest level of agreement – 16.7 percent – was with item D.6 '*senior managers do not enforce strict adherence to company procedures*' followed by 47.5 percent agreement with item D.4 '*senior managers do not provide detailed work instructions*'. These responses indicate that senior managers exercise strict control over their company's operations. The motivation to maintain strict control over business operations reflects the context under which shipping services are provided. Shipping operations entail risk of accidents that can cause damage to life, property and environment. Pervasive statutory requirements mean that shipping operations are conducted under a plethora of rules, regulations and codes. Hence adherence to procedures in compliance with prescriptive regulatory requirements is the norm.

A majority of senior managers agreed with item D.8 '*strategic plans are made in consultation with staff*' though the level of agreement (60.0 percent) is low enough to suggest that a command and control type management style is widely practised. Command and control type management style can result in disengaged, unmotivated staff who simply follow instructions and therefore provide limited contribution to the development of new ideas in the company (Wheatley 2008).

Table 6-15 shows the average response for each item related to competency development together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-15: Competency development

Competency development:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
D.12	Staff selection criteria includes ability to use initiative	4.13	0.78	0	0	2	1	18	9	30	90.0%
D.13	Staff selection criteria includes problem-solving ability	4.00	0.91	0	0	3	3	15	9	30	80.0%
D.14	Staff development activities target problem-solving skills	3.57	1.04	0	0	7	4	14	5	30	63.3%

With respect to hiring people who possess initiative and problem solving skills 90.0 percent of respondents agreed with the statement in item D.12 '*staff selection criteria include ability to use initiative*' and 80.0 percent of respondents agreed with item D.13 '*staff selection criteria include problem solving ability*'. However, a relatively low percentage – 63.3 percent – of respondents agreed with the statement in item D.14 '*staff development activities target problem solving skills*'. This suggests that many companies are content with hiring people with requisite skills and do not see the need for further skill development.

6.6.2 Supportive leadership

As discussed in Chapter Three, there are two indicators of supportive leadership – shared purpose and values and support for innovation. Table 6-16 shows the average response for each item related to shared purpose and values together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-16: Shared purpose and values

Shared purpose and values:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
D.1	Senior managers articulate a clear vision of the company's future	4.27	0.98	0	1	1	2	11	15	30	86.7%
D.2	Senior managers communicate company's vision to staff	4.27	0.83	0	0	2	1	14	13	30	90.0%
D.17	Managers embody organisational values in practice	4.40	0.67	0	0	0	3	12	15	30	90.0%

With respect to shared purpose and values items, 90.0 percent of respondents agreed with the statement in item D.2 '*senior managers communicate company's vision to staff*' and

90.0 percent of respondents agreed with item D.17 '*managers embody organisational values in practice*' followed by 86.7 percent agreement with item D.1 '*senior managers articulate a clear vision of the company's future*'. The high level of agreement with these items indicates that most senior managers communicate company's vision and values to staff. Shared understanding of organisation's vision and values facilitates staff efforts towards a common purpose (Palmberg 2009). One respondent described how people in their company were united by purpose:

> *...everybody is very much on the same page, in that we're all working for the one company, we're all trying to succeed for [owner's name], to make him the most amount of money as possible. But the overall attitude of the company is one of – we look after the staff very, very well, and we look after our customers very well, but we're very protective of the business we've got (OSM, Company #15).*

Table 6-17 shows the average response for each item related to support for innovation together with the frequency of responses against each level of agreement in the Likert scale. Items were designed to find out how shipping companies encourage behaviour that facilitates innovation.

Table 6-17: Support for innovation

Support for innovation:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
D.3	Senior managers set uncomplicated rules	4.23	0.73	0	0	1	2	16	11	30	90.0%
D.5	Senior managers focus on results	4.27	0.58	0	0	0	2	18	10	30	93.3%
D.7	Authority is delegated to the lowest qualified level	3.47	1.14	0	1	8	1	16	4	30	66.7%
D.9	Strategic plans are evaluated continuously	4.03	0.76	0	0	2	2	19	7	30	86.7%
D.10	Strategic plans are subject to modification at any time	4.13	0.82	0	0	2	2	16	10	30	86.7%
D.11	Staff are rewarded for innovative solutions	3.87	0.73	0	0	3	1	23	3	30	86.7%
D.15	Managers monitor staff workloads to enable time for reflection	3.30	1.06	0	1	8	6	12	3	30	50.0%
D.16	Managers are accessible to staff	4.77	0.43	0	0	0	0	7	23	30	100.0%

All respondents agreed with the statement in item D.16 '*managers are accessible to staff*'. Accessibility to managers enables staff to discuss new ideas and creative thinking directly with decision makers. As one respondent explained:

> *…our company is very well structured. People can walk in and say what they want, what they see. We have a culture where people are not afraid to speak their mind…that basically gives us much more resilience because people understand each other better (OSM, Company #30).*

There was 93.3 percent agreement with the statement in item D.5 '*senior managers focus on results*', 90.0 percent agreement with item D.3 '*senior managers set uncomplicated rules*' and 86.7 percent agreement with item D.11 '*staff are rewarded for innovative solutions*'. However, only 50.0 percent of responded agreed with the statement in item D.15 '*managers monitor staff workloads to enable time for reflection*'. Chuckles and laughs were heard from a few respondents during interviews when this item was read out. The respondents' reaction to item D.15 may either reflect ground realities of shipping operations that continue round the clock or that senior managers may have limited supervisory responsibilities over staff – six respondents were unsure of item D.15. An equal percentage of respondents – 86.7 percent – agreed with the statements in item D.9 '*strategic plans are evaluated continuously*' and item D.10 '*strategic plans are subject to modification at any time*'. This suggests that shipping companies are responsive to changing situations and flexible in the manner that objectives are achieved.

6.7 Robustness

The final series of Likert scale questions relate to robustness of the company, which refers to the ability of a company to withstand the impact of disruptions. As discussed in Chapter Three, recovery planning as well as modularity and response diversity were identified as two dimensions of robustness. The following sections analyse the responses to each of the two dimensions.

6.7.1 Recovery planning

As discussed in Chapter Three, there are two indicators of recovery planning – plans for recovery and training and practice. Table 6-18 shows the average response for each item related to plans for recovery and Table 6-19 shows the average response for each item related to training and practice. The tables show the frequency of responses against each level of agreement in the Likert scale.

Table 6-18: Plans for recovery

Plans for recovery:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
E.1	Written plans exist for crisis management	4.27	1.01	0	1	2	0	12	15	30	90.0%
E.5	Written plans exist for business continuity	3.90	1.16	0	2	2	3	13	10	30	76.7%

Table 6-19: Training and practice

Training and practice:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
E.2	Crisis management exercises are practised	3.80	1.32	0	2	5	2	9	12	30	70.0%
E.3	Managers receive crisis management training	3.37	1.27	0	2	8	3	11	6	30	56.7%
E.4	Staff receive crisis management training	3.07	1.34	0	3	11	2	9	5	30	46.7%
E.6	Business continuity exercises are practised	3.53	1.31	0	2	7	2	11	8	30	63.3%
E.7	Managers receive business continuity training	3.40	1.22	0	2	7	3	13	5	30	60.0%
E.8	Staff receive business continuity training	3.13	1.20	0	2	10	3	12	3	30	50.0%

With respect to the existence of plans, 90.0 percent of respondents agreed with the statement in item E.1 '*written plans exist for crisis management*' and 76.7 percent of respondents agreed with item E.5 '*written plans exist for business continuity*'. With regards to the practising of exercises, 70.0 percent of respondents agreed with the statement in item E.2 '*crisis management exercises are practised*' followed by 63.3 percent agreement with item E.6 '*business continuity exercises are practised*'. When asked about training, 60.0 percent of respondents agreed with the statement in item E.7 '*managers receive business continuity training*', followed by 56.7 percent agreement with item E.3 '*managers receive crisis management training*', 50.0 percent agreement with

item E.8 '*staff receive business continuity training*' and 46.7 percent agreement with item E.4 '*staff receive crisis management training*'. The declining level of agreement from the existence of plans to practise of exercises to training activities indicates that overall whilst plans exist in shipping companies to aid recovery following a disruption, limited opportunities are provided to practise response and recovery arrangements, validate plans, test assumptions, and build peoples' capability through training.

There were significant differences in response to items E.1, E.2, E.3, E.4 and E.8 between the group of companies operating in Australia only and the group of companies operating internationally. Table 6-20 shows the p-values obtained from Mann-Whitney U test for the five items as well as the average score of responses and percentage of respondents who disagreed or were unsure of the item from both groups of companies.

Table 6-20: Response differences based on area of operation

Item	p-value	Area of operation	Average response	Percentage of disagree/unsure responses
E.1	0.035	Australia	4.75	0
		International	3.94	16.67
E.2	0.015	Australia	4.50	16.67
		International	3.33	44.44
E.3	0.025	Australia	4.00	16.67
		International	2.94	55.55
E.4	0.013	Australia	3.83	25.00
		International	2.56	72.22
E.8	0.028	Australia	3.75	25.00
		International	2.72	66.67

For all five items in Table 6-20, the average score of responses was higher for companies operating in Australia only as compared to companies operating internationally. The difference is caused by a higher proportion of respondents from companies operating internationally disagreeing or being unsure about the items than respondents from companies operating in Australia only. Compared to companies operating internationally, more companies operating in Australia only have crisis management plans, practise crisis management exercises, give crisis management training to managers and staff, and give business continuity training to staff. In general terms, based on the area of operation, companies operating in Australia only have less response diversity than companies operating internationally due to limited number of markets. Hence, greater investment in recovery planning may be an attempt by companies operating in Australia only to develop defensive capabilities.

With respect to items E.7 and E.8, the Mann-Whitney U tests showed significant differences in distribution of responses between companies that had experienced disruption and companies that had not experienced disruption. Table 6-21 shows the p-values obtained from Mann-Whitney U tests for the two items as well as the average score of responses and percentage of respondents who disagreed or were unsure of the item from both groups of companies.

Similar to all previously discussed items for which the Mann-Whitney U tests have shown significant differences between companies based on their experience of disruption (items B.16, C.3, C.4, C.8 and C.10), the average score in items E.7 and E.8 is higher, and the percentage of disagree/unsure responses lower, for companies that have experienced disruptions. It is unclear whether the higher level of agreement with items E.7 and E.8 by respondents from companies that had experienced disruptions is a consequence of lessons learnt from disruptions or there is some other explanation. Overall however, the data

shows that companies that have experienced disruptions provide staff incentives to report disruptions, make staff aware of the limitations of plans and engage staff and managers in training and exercises to a greater extent than companies that have not experienced disruption.

Table 6-21: Response differences based on experience of disruption

Item	p-value	Experienced disruption	Average response	Percentage of disagree/unsure responses
E.7	0.038	Yes	4.33	16.67
		No	3.34	45.83
E.8	0.006	Yes	4.33	0
		No	3.07	62.50

6.7.2 Modularity and response diversity

As discussed in Chapter Three, there are two indicators of modularity and response diversity – back-ups and business diversity. Table 6-22 shows the average response for each item related to back-ups together with the frequency of responses against each level of agreement in the Likert scale.

Table 6-22: Back-ups

Back-ups:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
E.9	Critical back-up resources are maintained	4.23	0.68	0	0	1	1	18	10	30	93.3%
E.10	Staff are trained to perform a variety of tasks	4.23	0.63	0	0	1	0	20	9	30	96.7%
E.11	Front-line staff are empowered to make appropriate decisions as first responders	4.20	0.81	0	0	1	1	17	11	30	93.3%
E.12	Supportive relationships are cultivated with key customers	4.63	0.49	0	0	0	0	11	19	30	100.0%
E.13	Supportive relationships are cultivated with key suppliers	4.23	0.97	1	0	0	1	16	12	30	93.3%
E.14	Supportive relationships are cultivated with key business partners	4.53	0.51	0	0	0	0	14	16	30	100.0%
E.15	Supportive relationships are cultivated with key community groups	3.57	1.25	2	0	2	6	15	5	30	66.7%

Overall, the companies maintain supportive relationships with stakeholders that can be called upon for assistance and advice if needed. All respondents agreed with item E.12 '*supportive relationships are maintained with key customers*', all respondents also agreed with item E.14 '*supportive relationships are maintained with key business partners*', 93.3 percent of respondents agreed with item E.13 '*supportive relationships are maintained with key suppliers*' and a relatively low 66.7 percent of respondents agreed with item E.15 '*supportive relationships are maintained with key community groups*'. With respect to item E.15, the Mann-Whitney U test revealed significant differences (p-value = 0.039) between companies operating in Australia only and companies operating internationally. The difference is caused by two 'not applicable' responses from companies operating internationally while no 'not applicable' response came from companies operating in Australia only. Across all 30 responses, six respondents were unsure, two disagreed and two reported 'not applicable'. Out of these10 respondents, eight represent tramp shipping companies which suggests that since tramp ships do not normally operate on fixed routes, there is limited opportunity, or even need, for some tramp shipping companies to cultivate relationships with geographically placed communities.

Overall, the respondents were also confident with their back-up arrangements for staff and resources. This was evident because 96.7 percent of respondents agreed with the statement in item E.10 '*staff are trained to perform a variety of tasks*' and an equal 93.3 percent of respondents agreed with item E.9 '*critical back-up resources are maintained*' and item E.11 '*front-line staff are empowered to make appropriate decisions as first responders*'.

Table 6-23 shows the average response for each item related to business diversity together with the frequency of responses against each level of agreement in the Likert scale. There was high level of agreement with the two items – 96.7 percent of respondents agreed with

the statement in item E.16 '*the company does not rely on a single market*' and 83.3 percent of respondents agreed with item E.17 '*the company's ships are capable of transporting more than one kind of cargo*'.

Table 6-23: Business diversity

Modularity and diversity:				Frequency							Agree or
Item	Statement	Mean	SD	0	1	2	3	4	5	Tot	strongly agree
E.16	The company does not rely on a single market	4.50	0.68	0	0	1	0	13	16	30	96.7%
E.17	The company's ships are capable of transporting more than one kind of cargo	3.97	1.63	3	1	1	0	9	16	30	83.3%

However, the data contained in Table 6-23 may be misleading. Respondents may have construed 'market' and 'one kind of cargo' in different ways. For example, even the company which operates the same types of ships on a single route reported that it did not rely on a single market. Similarly, some confusion may have been created, for example, whether 'one kind of cargo' means a freight container carrying any type of cargo or one type of cargo carried within the container. In hindsight, greater clarity should have been provided in the statements.

Ten respondents (33.33 percent) provided examples of business diversity in their company, expressed either as the number of ships operated, geographical area of operation, or the variety and multitude of customers. Generally, business diversity was viewed in favourable terms, supporting the findings from CAS literature that high modularity and response diversity have a favourable impact on resilience. Four examples presented below illustrate how business diversity provides flexibility of response in changing conditions as well as limiting the impact of a disruption in a particular market. One respondent provided an example of how a ship could be deployed from one market to another in case one market was disrupted:

> *...the most useful measure of being able to counteract disruption in a particular trade lane is having a critical mass of ship and cargo, around the world. If a trade*

lane should overnight disappear, that we have the ability to use those same ships in another area. For instance, the ships that we use from New Zealand for logs are just as good as loading logs from South America or loading from the North Pacific (OSM, Company #12).

Companies that are tightly linked to their market have less modularity and are therefore more vulnerable to disruption caused by the market. One respondent described how their company was affected when a major customer's ownership changed hands and the new customer had different expectations to the previous owners:

...the new owners are driven more financially than service orientated. So, they're looking to cut costs and of course we've had to reduce our freight rates. Basically they've been looking for higher levels of service at lower costs all the time and we've had to respond accordingly (CEO, Company #26).

Another respondent remarked how their company was better positioned to respond to threats than their competitors due to the number of ships that they operated:

...we have a critical mass of ships, so should there be a known threat we can perhaps, work our way around that. Whereas competitors of ours may have their less tonnage around and may not have the same sort of deployment flexibility as an organisation like [name of company]' (CEO, Company #10).

The OSM of Company #11 expressed a similar view regarding the size of their company, stating that size puts them in a better position than competitors:

...if there were some major disruptions to business, it would not be easy to ride out. But certainly, we would be in a better position than a lot of our competitors because of the size of the company (OSM, Company #11).

6.8 Respondents' characterisation of resilience

In questions A.37 – A.40 of the Interview Questionnaire, respondents were asked to explain their understanding of the term resilience. Out of the 30 respondents, three (10.00%) used the term resilience in internal company documents, 11 (36.67 percent)

used the term in conversations within their company, seven (23.33 percent) did not use the term within their company but had an opinion on what the term meant. Six of these 21 respondents clarified that they used other terms to denote resilience – two using the term sustainability, and one each using risk mitigation, risk assessment, business continuity and knowledge management. The remaining nine respondents (30.00 percent) had no opinion on the meaning of resilience or an alternative term. This suggests that the term resilience may not yet be an established part of senior managers' vocabulary in shipping. The descriptions of resilience from the respondents are summarised in Table 6-24.

As shown in Table 6-24, 15 respondents (50.00 percent) provided descriptions of resilience that related to their company's ability to recover, survive, withstand adverse situations or to manage risks. Conceptually, such definitions assume a single-equilibrium state for the company as discussed in Chapter Two. Six respondents (20.00 percent) described resilience in terms of the company's ability to adapt to changing circumstances. Conceptually, the view of resilience as adaptation assumes a multi-equilibrium state for the company. Hence, there is no shared meaning of resilience among senior managers supporting the view in the literature that the term resilience has multiple meanings attached.

In question A.41 of the Interview Questionnaire, respondents were asked to rate their company's resilience on a scale of one to 10 with one being the least resilient and 10 being the most resilient. The rating scores are shown in Appendix K. In general, the respondents gave high scores with the mean value being 7.57. The scores suggest that respondents are generally confident about their company's ability to cope with disruptions. However, these scores need to be treated with caution. Conversation with respondents suggested that most had not conceptualised resilience in depth. The use of

terms such as risk mitigation and sustainability by some respondents further strengthens this view. It had been anticipated that the term resilience may not be treated with the same meaning among the respondents. Hence, except for questions A.37 – A.42, the word resilience was not used in any other item or question. Questions A.31 and A.35 which asked the respondents to rate their company's effectiveness in reducing the likelihood of disruptions and preparedness to withstand disruptions respectively, were deliberately designed to elicit responses which targeted two aspects of resilience – avoiding disruptions and withstanding disruptions.

Table 6-24: Respondents' characterisation of resilience

Number	Conceptual frame	Description
15 (50.00%)	Single-equilibrium	*…managing risks (CEO, Company #1)* *…ability to absorb hits that can be financial, work site incidents or loss of people…ability to recover (CEO, Company #3)* *…being able to take your depth of people and your depth of expertise, your depth of your equipment and your depth of financial ability to be able to absorb hits (OSM, Company #4)* *…business continuity (CEO, Company #5)* *…limiting external influences on the company so company is insulated and protected (CEO, Company #6)* *…ability to cope with market changes and fluctuations (OSM, Company #11)* *…surviving markets like we had in 2008 where there is massive volatility in market levels (OSM, Company #12)* *…ability to continue doing business (OSM, Company #17)* *…ability to bounce back promptly and effectively when things go wrong (OSM, Company #19)* *…no loss should hit us that we didn't foresee…being prudent and cautious and properly risk assessing steps before we actually make decisions (CEO, Company #20)* *…the ability to continue operating in tough environments successfully…on a long-term basis (OSM, Company #22)* *…the ability to be able to recover quickly from any event, without the loss of data and without the loss of staff or without taking any risks and being able to meet the needs of shipping (CEO, Company #23)* *…capturing knowledge in our system's procedures so that we don't lose that experience, that knowledge…due to volatility (OSM, Company #25)* *…ability to meet a challenge, a financial or operational stress on the business (CEO, Company #26)* *…ability to bounce back (OSM, Company # R29)*
6 (20.00%)	Multiple-equilibrium	*…continuing to provide the level of service that customers and clients dictate, over an extended period of time through multiple business cycles or, indeed, potential disruptions like cyclones (CEO, Company #2)* *…being able to adapt or change to changing market conditions (OSM, Company #9)* *…ability to be adaptable and proactive toward unexpected change or changes in the market (CEO, Company #10)* *…the ability to assess and critique effectively different areas of the market and make adjustments accordingly (OSM, Company #21)* *…the ability to come back from challenge or adversity, to overcome things, to change and adapt (CEO, Company #27)* *…being able to adapt to ups and downs, both in local market and in international market (OSM, Company #30)*
9 (30.00%)	None	*(OSM, Company #7), (CEO, Company #8), (OSM, Company #13), (OSM, Company #14), (OSM, Company #15), (OSM, Company #16), (CEO, Company #18), (CEO, Company #24), (CEO, Company #28)*
30 (100.00%)	Total	

6.9 Summary

Managerial activities to cope with disruptions in shipping companies are mainly focussed on planning and control measures to withstand disruptions. However, other activities occur in companies that contribute towards the resilience capabilities of awareness, learning ability, innovativeness and robustness as suggested by literature, with some exceptions. Notable exceptions include areas such as training for contingencies, dissemination of information related to failures and company limitations, and managerial control over procedures. Staff competence can be leveraged to a greater extent than occurs currently in shipping companies. There is no universally shared meaning of resilience among senior managers of shipping companies but they are confident about their company's ability to cope with unexpected disruptions and threats. Risk based decision-making and stakeholder relationship management are key areas for managing market related threats. Modularity and diversity influence the impact of disruptions. The next chapter provides a summary of this study and draws conclusions from survey data and literature review to answer the research questions.

CHAPTER 7: SUMMARY AND CONCLUSIONS

7.1 Introduction

This thesis is based upon an exploratory study of organisational capabilities that contribute towards the resilience of shipping companies. In this final chapter, findings from the exploratory study are summarised and conclusions drawn to answer the primary and secondary research questions. The purpose of the research is reiterated to contextualise the findings. The value of the study is highlighted, both in terms of its contribution to theory and contribution to management practice in shipping. The chapter and thesis ends by outlining potential limitations of this study and identifying areas of future research.

7.2 Purpose of the research

The literature, as discussed in Chapters Two and Three, reveals that increasing volatility in natural, economic and social systems is causing unprecedented challenges for organisations in coping with changing circumstances that are becoming more turbulent, complex and uncertain. Traditional management approaches in organisations are based upon managers relying on their ability to foresee future risks and putting measures in place to mitigate such risks. However, it is difficult to foresee the future because change is no longer linear and predictable in the 21st century (McKenzie 2014). Globalisation and technological advances have created a complex system of interconnected individuals, organisations, communities and institutions whereby the effects of changes in the system are difficult to comprehend and plan (McDaniel 2007). Therefore, when circumstances change in unexpected ways, many organisations may be unprepared to carry out their business as intended (Goldspink, Kay & Hills 2010).

As explained in Chapter One, similar to other organisations, shipping companies face unforeseen and unexpected circumstances whose complexity is compounded by the companies' centrality in global trade and their exposure to natural phenomenon. The ability of shipping companies to continue providing transport services in a viable manner in the face of unforeseen and unexpected circumstances is essential for societal well-being. From a managerial perspective, the challenge is how to prepare shipping companies to cope with unexpected disruptions to their business when it is not known beforehand how, or in what shape or form, disruptions might occur. The literature (see, for example, Boin & van Eeten 2013; Burnard & Bhamra 2011; Dahms 2010; Hollnagel 2014; Seville 2017; Välikangas 2010) suggests that the focus should be on building organisational resilience in the face of uncertainty. However, only a limited number of empirical studies such as Kay and Goldspink (2012), Lee, Vargo and Seville (2013) and McManus (2008) have been conducted on the measures that can be implemented to develop organisational resilience capabilities.

Empirical research on the resilience of shipping companies is rare and the few studies that have been carried out are highly contextualised (see, for example, Fischer et al. 2016; Gurning & Cahoon 2011; Lam & Bai 2016; Mason & Nair 2013). No empirical study is known to include the shipping company as a unit of analysis where the focus is on unspecified threats and disruptions. Moreover, the term resilience is sometimes used as a metaphor and sometimes in specific contexts (Carpenter et al. 2001). It is unclear how the decision makers in shipping companies – the senior managers – understand resilience and whether their understanding of resilience guides them in developing their company's resilience capabilities.

To address these gaps in knowledge, this thesis sought an answer to the following primary research question (PRQ):

PRQ: How can shipping companies develop organisational resilience capabilities?

7.3 Summary of responses

PRQ was addressed by posing three secondary research questions (SRQs):

SRQ1: Which organisational capabilities contribute to the resilience of shipping companies?

SRQ2: How do senior managers of shipping companies develop their organisation's resilience capabilities?

SRQ3: How is organisational resilience characterised by senior managers of shipping companies?

Primary data to answer the SRQs was collected by conducting 30 interviews of senior managers representing 57.14% of all shipping companies operating in Australia. The questionnaire used was designed as a semi-structured instrument consisting of open-ended questions, closed-ended questions and statements requiring Likert scale responses. Senior managers were asked to describe their experiences in coping with actual disruptions and threats. In addition, senior managers were asked to indicate their level of agreements with statements about activities which, as indicated by the literature review, contribute towards developing organisational resilience capabilities. Senior managers were also asked to explain their understanding of the term 'resilience'. The response to SRQs is summarised as follows.

7.3.1 Response to SRQ1 and SRQ2

Descriptions of respondents' experiences in coping with threats and disruptions were sought in order to identify the organisational capabilities actually utilised, or those capabilities that could have been utilised, to overcome threats and disruptions. As mentioned previously, respondents reported a variety of threats and disruptions faced by their companies, confirming the literature's view that shipping companies operate in an environment where multifaceted threats emerge unexpectedly from diverse causes. The study found that disruptions are not uncommon in the shipping industry for two reasons. First, senior managers make trade-offs between the extent to which a company is protected versus exposure to threats arising as a consequence of exploiting business opportunities. Second, humans in general are limited in their capacity to anticipate and foresee all future events due to the complexity created by interactions between companies, markets, people, communities, institutions and the natural environment (McDaniel 2007). This was confirmed by remarks made by several respondents that it was not possible to foresee every challenge.

Although the likelihood of shocks and stresses caused by unforeseen developments remains, the value of building resilience capabilities to avoid and/or withstand disruptions is not diminished. The disruptions reported by the respondents varied in scale in terms of their impact on the company. The variance in impact resulted from differences in the extent of modularity and diversity among the companies, and the adequacy of response. Major disruptions were reported by six respondents (20.00 percent), all of whom had worked in their present company for more than five years. In all six cases, the companies were able to successfully withstand the impact of disruption and maintain their

functionality. Hence despite experiencing disruptions, these companies can be considered to be resilient for at least the past five years. There were five (16.67 percent) respondents who had worked for less than five years in their present company and did not report any major disruption. Even if it is assumed that their companies may have experienced a major disruption in the past five years that the respondents were not aware of, they represent a small proportion of the sample. Hence it can be concluded that overall, the companies represented by the sample have been resilient for at least the past five years.

The view that the sample consists of resilient companies is supported by the self-rating of organisational capabilities by respondents. On a scale of one to 10 where one is the least effective and 10 is the most effective, respondents gave high scores (mean score 7.57) to indicate their company's effectiveness in reducing the likelihood of unexpected disruptions. Similarly, on a scale of one to 10 where one is the least prepared and 10 is the most prepared, respondents gave high scores (mean score 7.87) to indicate their company's preparedness to withstand the impact of unexpected disruptions. No significant relationship was found between the rating scores and company characteristics such as the size of company indicated by number of ships operated, area of operation – Australia or international, category of ships operated – oil tankers, bulk carriers, general cargo ships, container ships or other ships, and whether a company had experienced a major disruption in the past. Given that shipping has been in serious economic downturn since the financial crisis of 2008 (ICS 2017), the high rating scores together with the successful management of disruptions for at least the past five years suggest that the activities occurring in shipping companies in the sample are prescriptions for developing resilience capabilities.

Although the notion of situational awareness in organisational studies is usually applied in the context of crises and disasters (see, for example, Leonard & Howitt 2012;

McManus 2008; Stephenson 2010), the study found that senior managers utilise their awareness of the market to assess competition and identify threats and opportunities. This aligns with the view of Seville (2017) that resilience capabilities contribute towards competitive advantage. Examples provided by respondents suggest that awareness of the business environment is necessary to assess risks associated with potential opportunities so that countermeasures against likely disruptions can be taken or decisions made to forego an opportunity if the risks are deemed too high.

The freight market boom and bust cycles of high and low freight rates are difficult to predict and the challenge for shipping companies is to maintain functionality during those periods when low freight rates are insufficient to cover operating costs. Examples provided by respondents indicate that securing of long term finance helps reduce vulnerability to market cycles. Maintaining long term relationships with customers helps to protect revenue streams. Divesting surplus assets, outsourcing and forming strategic partnerships with competitors helps cuts down costs. The above examples illustrate the utility of response diversity.

The study highlights the importance of having awareness of stakeholders' expectations. Examples provided by respondents illustrate how effective relationship management and communication with stakeholders may help reduce the element of surprise from threats and disruptions arising from stakeholders' actions. In a highly regulated environment, awareness of the expectations of governments and other authorities is especially important.

Prescriptions of resilience from fields other than shipping were applied in this study in the form of Likert scale items. The study finds that prescriptions from the literature, as discussed in Chapter Three, are relevant to the development of resilience capabilities in

shipping companies. For example, the survey shows that in general, within respondents' companies, activities are taking place that raise awareness of company's strengths and weaknesses among its personnel. Interactions take place within companies, and personnel are aware of theirs and others' roles and responsibilities as well as their company's performance expectations. In addition, interactions take place between employees and stakeholders so that personnel are aware of their company's external environment. With respect to activities that contribute to innovativeness, in general, senior managers of respondent companies provide clear direction to their employees, are responsive to changing circumstances, and are flexible in the way that goals are achieved.

There are however some prescriptions from the literature that are not prevalent in shipping companies. With respect to staff empowerment, although companies hire staff with problem-solving and initiative skills, senior managers provide detailed work instructions and expect strict compliance of procedures from their employees. In many companies, staff are not consulted when preparing strategic plans. Similarly, with respect to activities that contribute towards learning, although communication within the company is encouraged, information regarding past failures and limitations of company plans is not widely shared. As discussed in Chapter Three, the above approach is symptomatic of a command and control type thinking which is characterised by a top-down hierarchical perspective (Zokaei, Seddon & O'Donovan 2011). Since the beginning of the 20th century, there has been a culture of compliance in shipping which promotes a command and control type approach (Kristiansen 2005). As discussed in Chapter Three, some scholars argue that 21st century organisations should adopt a management style based on CAS whereby managerial control is replaced by self-organisation. This study finds that since shipping involves the use of high risk technologies with potential for disasters and wide-spread destruction of life, property and environment, there is little justification for

devolving managerial control as the risks may be unacceptable to shipping companies and stakeholders. In addition, shipping companies are service organisations that exist to serve the transport needs of their customers. It is logical to assume that 21st century customers' demands for reliable, punctual, visible and safe transportation require effective control over shipping services.

7.3.2 Response to SRQ3

As discussed in Chapter Two, Carpenter et al. (2001) suggest that in order to understand the meaning of resilience, it is necessary to clarify resilience *of* what *to* what. Since the focus of this study is on the resilience *of* shipping companies it was necessary to obtain data that was applicable *to* the resilience of the whole of shipping company. When considering resilience, spatial scale is important because a company can be resilient at one scale – for example at the level of an individual ship – but may not necessarily be resilient at the company level and vice versa. All responses obtained from senior managers for this study were analysed with reference to the resilience *of* their company.

Regarding resilience *to* what, data was collected concerning shipping companies' resilience capabilities *to* disruptions. In Chapter Two, following Fischer and Zink's (2012) model of a work system, disruptions were conceived as unplanned and undesirable deviations or interruptions to organisational functions that convert inputs into outputs. Several instances of threats and disruptions were reported by senior managers that were caused either by market forces or due to non-availability of resources for providing shipping services. Market related threats and disruptions were reported by senior managers as arising from a variety of causes such as volatility in freight markets, collapse of markets, actions of competitors, unpredictability of stakeholders' expectations, and non-payment by customers for services rendered. These affected a critical input for

shipping companies – the demand for shipping services and hence the revenue. As reported by senior managers, the resource inputs required by shipping companies – ships, port infrastructure, people, supplies and technology – were affected by a number of causes such as natural calamities, accidents, strikes and cyber-attack.

In Chapter Two, organisational resilience, as used in this thesis, was defined as follows:

> *Organisational resilience is the ability of an organisation to maintain functionality in a disruptive environment. Maintaining functionality means that an organisation continues to provide value and fulfil expectations – in the manner, and over a period of time – as determined by its shareholders and stakeholders.*

During their interview, senior managers were asked to explain their understanding of the term resilience. There was a two-fold purpose in asking this question – first, to determine if senior managers share a common understanding of resilience and second, to evaluate the influence of senior managers' understanding of resilience on organisational activities that contribute to the development of resilience capabilities.

There appears to be no shared meaning of resilience among senior managers of shipping companies. The most common view of resilience, expressed by 50.00 percent of respondents, is described in the literature as engineering resilience. The engineering resilience view is based upon conceptualising a single-equilibrium state for a company where resilience means the ability to survive or recover to the company's pre-disruption state. A small percentage (20.00 percent) of respondents explained resilience in terms of their company's adaptability to change – a view that assumes that a company can exist in more than a single state of equilibrium. The adaptability view of resilience implies maintaining functionality in response to change that occurs relatively slowly over a longer time frame (Martin-Breen & Anderies 2011) as opposed to the engineering resilience

view in which resilience implies quick recovery following a disruption (Holling 1996). This does not mean however that capabilities for engineering resilience are less important. To maintain functionality over longer time periods, a company must also have the capability to withstand and recover from all disruptions that may occur over shorter time frames. Among senior managers, 30.00 percent had no view on resilience. This suggests that not only is there no shared understanding of resilience among senior managers, but also that the notion of resilience is still under development in the shipping industry.

The preceding discussion should not be construed as suggesting that senior managers do not take measures that contribute to resilience capabilities of their companies. As explained in the following sub-section, activities occur in shipping companies which, the literature suggests, contribute to the development of resilience capabilities. Therefore, it appears that regardless of their viewpoint on resilience, senior managers in the sample are facilitating activities to develop resilience capabilities in order to maintain their company's functionality under challenging circumstances. Hence, the definition of resilience developed from the literature review in this study is relevant to shipping companies.

7.4 Response to PRQ

Senior managers of shipping companies mostly rely on traditional management techniques of planning and control when taking deliberate actions to prepare their company for disruptions. Traditional management techniques involve planning and control mechanisms for reducing risks, mitigating risks in anticipation, and developing capabilities for effective crisis response (Martin-Breen & Anderies 2011). The premise is that if as many risks as possible are foreseen, then there is less chance of the company being surprised by an unexpected event. Once a risk is assessed, a decision can be made

whether to mitigate such risk or to avoid a particular business activity if the risk is considered unacceptable. Common risk mitigation includes measures such as having alternate plans of action, taking out insurances and hedging. While such activities remain relevant, this study recommends that a fresh approach based upon consideration of modularity and response diversity in shipping companies can add further value to developing resilience capabilities.

As previously mentioned, the extent to which shipping companies are affected by threats and disruptions is influenced by the extent of modularity and response diversity in the company. Modularity assists in localising impact of threats and disruptions. Companies with less modularity are more vulnerable to disruptions than those with greater modularity. However, assessing modularity with the intention of increasing it may not be straight forward as modularity is contextual. For example, it may appear that a large shipping company has more modularity than a small company in case of an accident involving one of their ships. Continuing the example, if the large company's business is closely linked to its reputation and the accident causes loss of reputation, its business may be seriously affected. To assess modularity therefore, the study suggests that the focus should be on identifying strong linkages between the parts that constitute the company and its operating environment. An approach to develop resilience capabilities based upon consideration of modularity and diversity may help identify areas that need to be strengthened – for example, relationship management with key customers.

This study proposes that senior managers should identify the inputs needed to provide value to their customers and shareholders and assess the strength of their linkage to the company's viability. Possible inputs may include revenue, ships, ports and hinterland infrastructure, technology, business premises, labour, essential supplies and regulatory requirements as suggested by Figure 2-4 in Chapter Two. The aim should be to decrease

the tightness of links between inputs and company's viability so that a disruption is localised. Where the links remain strong, efforts should be directed towards increasing response diversity where possible.

Response diversity may be achieved by increasing the variety of markets, facilities, organisational units, people, suppliers and technology that a company relies upon. In Chapter Three, response diversity was conceptualised as a dimension of robustness capability to withstand the impact of disruptions. The study found that the flexibility provided by response diversity has wider application in influencing how companies may avoid disruptions or exploit new opportunities. For example, response diversity may enable a company to exploit new markets or shift its business from a less profitable area to a more profitable area. At the operational level, increasing response diversity may take the form of developing alternative business plans. At the strategic level, it may mean diversifying business. Hence, the conceptual framework developed from literature review shown in Figure 4-1 of Chapter Four is modified to include response diversity as a distinct capability that contributes to the avoidance of disruptions through adaptation. The modified conceptual framework is shown in Figure 7-1. As indicated in Figure 7-1, the organisational capabilities of awareness, learning, innovativeness, response diversity and robustness may contribute towards maintenance of functionality by enabling a company to either avoid disruptions through adaptation or to withstand disruptions by minimising damage and recovering quickly.

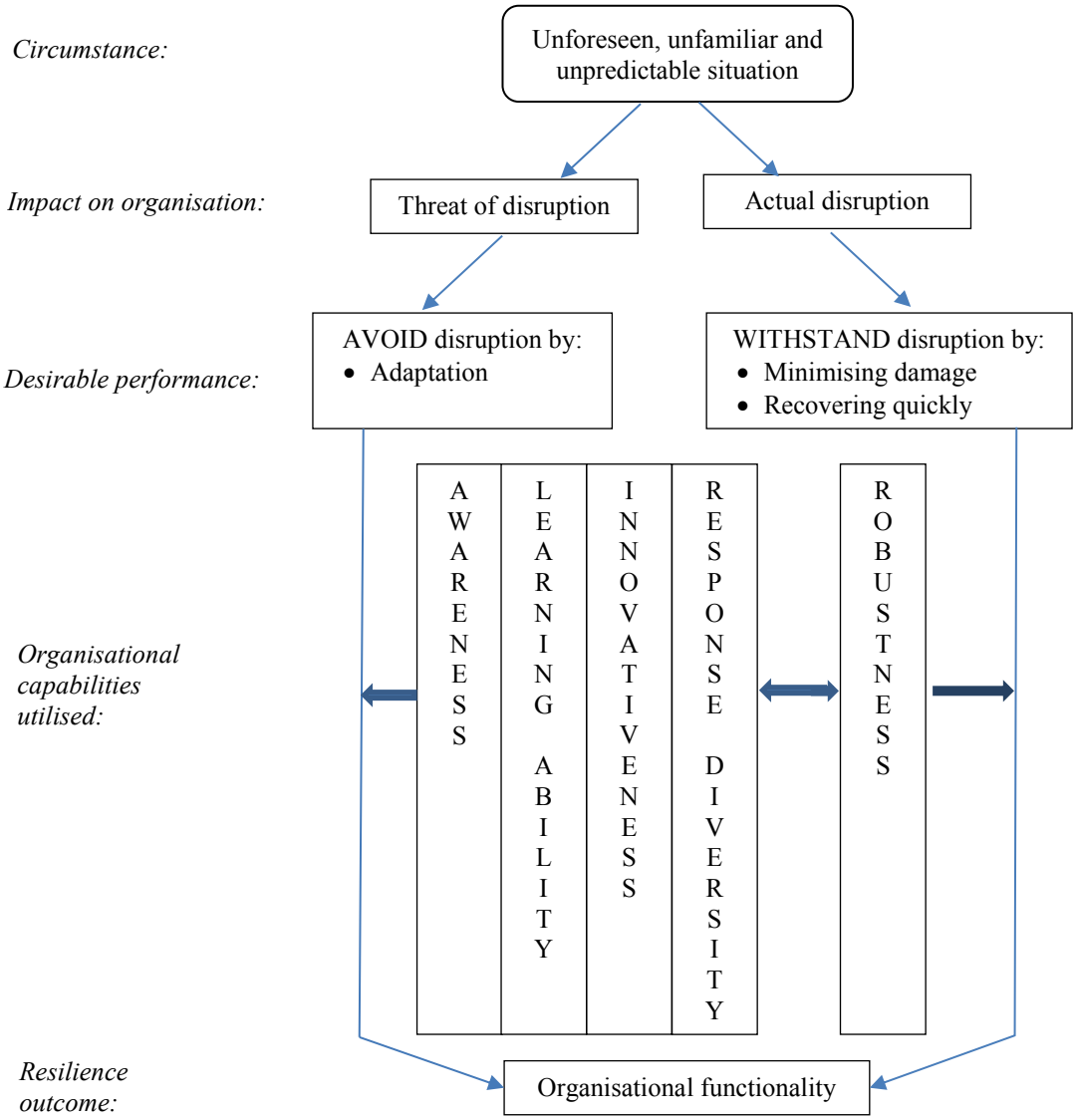


Figure 7- 1 Modified conceptual framework

7.5 Contributions of the research

Research on resilience in the shipping industry has been limited to either specific contexts such as safety (see, for example, Lutzhoft et al. 2006) or to spatial scales where the shipping company is one component of the system being studied (see, for example, Lam

& Bai 2016). This study contains what appears to be the first in-depth research on resilience which is unrelated to a specific threat and the shipping company is the unit of analysis. As such, it provides a unique perspective on the activities occurring in a vital cog in marine transportation. The theoretical and managerial contributions of this study are as follows:

- The study provides a definition of resilience modified from Carpenter et al. (2001). The definition enables resilience to be understood in terms of resilience *of* what *to* what *for* what. This understanding helps convert resilience from a metaphor into an operational construct that may be readily applied to all organisations, not just shipping companies. By focussing on functionality, the definition attempts to reconcile the tension between the dual aspects of resilience highlighted in the literature – stability and change.
- The study applies findings from research in other fields for the first time to shipping companies and finds that awareness, innovativeness, learning, response diversity and robustness capabilities are relevant to the resilience of shipping companies.
- Findings from this study provide empirical support that modularity and diversity contribute to the resilience of shipping companies. Past empirical studies of modularity and diversity have been mainly confined to socio-ecological systems. This study extends the concepts of modularity and diversity to organisations.
- The study suggests there is a link between resilience and competitive advantage. By understanding this relationship, senior managers of shipping companies may be able to assess how actions taken for competitive advantage impact on the resilience of their company. The notion of resilience is not yet fully understood by senior managers of shipping companies. Viewing resilience through the lens

of competitive advantage may assist senior managers in fully grasping the importance of resilience and the activities that contribute to building resilience capabilities.

- The study provides practical advice to senior managers on how to build resilience capabilities in their company by recommending an approach based upon consideration of modularity and response diversity.
- The study adds to the limited number of empirical studies that address resilience from the perspective of both avoiding disruptions and withstanding disruptions.
- From a methodological perspective, the study highlights that busy elites do not always read emails inviting them to participate in research. Multiple attempts and means of approach such as the use of social media and telephones as well as endorsement from relevant associations are helpful in attracting the attention of elites.

7.6 Limitations of the study

Findings from this study should be considered by keeping in mind the limitations of this study. This study explores the organisational capabilities that contribute to the resilience of shipping companies. The main and extensive focus of the study is highly qualitative which serves the purpose of exploring the notion of resilience, but with limited contribution to quantifying resilience. Therefore, while the study makes a unique contribution to understanding the resilience capabilities of shipping companies, further studies based on a greater proportion of quantitative design and analysis may be useful in providing a more objective assessment of resilience capabilities – for example, through testing of hypotheses and the use of different statistical processes to examine relationship between variables. Further limitations arise from the choice of sampling method which

affects generalisability, the reliance on a single person from each company to provide primary data, and the limitations of respondent' experiences of disruptions.

Being an exploratory study, telephone interviewing was selected as the appropriate method of data collection as it enabled the researcher to ask probing questions and clarify meanings. With practical difficulties in contacting senior managers of more than 5000 companies engaged in deep sea trade alone (Stopford 2009) plus many others engaged in coastal trade around the world, purposive sampling was selected over random sampling. Shipping industry publications, shipping associations and the respondents themselves were relied upon for controlling researcher bias in selecting the sample. However, purposive sampling does not enable precise and accurate generalisations to be made (Singleton & Straits 2010). Shipping companies operate in Australia under a legal framework for business conduct, labour welfare and environmental protection. Similar legal frameworks may not exist or be applied as strictly in some other countries as it is in Australia. Variations in cultural practices and norms may affect how companies are managed. With the caveat that there may be managerial practices that are not captured by this study, broad inferences can yet be drawn because 60.0 percent of companies surveyed are headquartered overseas and in total, companies operate a diverse range of ships that represent all five categories as per UNCTAD (2015).

Primary data for the study represents the views of a single person from each shipping company. Although senior managers are considered appropriate persons for answering questions relating to the organisation as a whole, perspectives from more operationally focussed staff may have provided greater depth of understanding the activities that occur in shipping companies.

The study provides a snapshot of resilience-related activities occurring within shipping companies in Australia. Since resilience is concerned with how disruptive change is managed by companies, a longitudinal study of Australian shipping companies may have provided greater opportunity to explore the resilience of companies in managing disruptive change over time. A longitudinal study may have also provided an opportunity to observe if continual change occurs in companies as suggested by the heuristic adaptive cycle model suggested in the literature.

7.7 Directions for future research

This study is culturally grounded in Australia. Studies of shipping companies that operate in countries that are culturally distant from Australia may add to knowledge about how shipping companies are managed for resilience in different cultural contexts and the extent to which findings of this study apply. In particular, the extent of differences if any, between different management styles may be relevant to managing companies for resilience.

As this study has focussed on disruptions to organisational functions that convert inputs into outputs, there is value in studying how shareholders' and stakeholders' expectations of outputs may influence managerial activity for resilience. A study involving consideration of shipping company ownership structures may provide additional insights into the way resilience is influenced by owners' expectations. In addition, analysis of major and minor disruptions reported by respondents suggests an inverse relationship between resilience and the extent of modularity in a shipping company. Furthermore, there appears to be a directly proportionate relationship between resilience and response diversity. These two relationships are supported by empirical studies of complex adaptive systems in the field of ecology (see, for example, Walker and Salt 2006). Hence, this

thesis suggests testing of these relationships in the context of shipping companies as a topic of future research.

Further research topics could include:

- Case studies of shipping companies that have failed to maintain their functionality;
- Studies of resilience from the perspectives of operational staff to investigate the extent to which activities intended by senior managers are actually occurring and contributing to building resilience capabilities;
- The extent of, and the manner in which competitive advantage is influenced by resilience capabilities;
- The influence of shareholders' and stakeholders' expectations on shipping companies' resilience;
- Investigation into similarities (if any) and differences (if any) in how shipping companies that operate in different market sectors develop resilience capabilities;
- Longitudinal studies of Australian shipping companies to investigate how change is managed over time; and
- The influence of individuals' resilience on the resilience of their company because companies' resilience is influenced by the actions of their employees. Findings of such a study may be especially useful to managers of shipping companies who typically employ people from diverse cultures, backgrounds and nationalities.

This thesis contributes to the small and emerging body of empirical research pertaining to organisational resilience. Any study on organisational resilience that is unspecific to a particular context or threat must address this apparent paradoxical question: *How can organisations plan to cope with situations that are unforeseen*? There is no panacea for

coping with unforeseen situations. A common colloquial idiom suggests to ‘prepare for the worst and hope for the best’. While organisations can prepare for the worst by developing their capabilities for robustness and increasing modularity, it is unlikely that they can maintain their functionality by hope alone. The key to coping with unforeseen situations may lie in developing organisational capabilities that enable organisations to change and adapt as change occurs. Increasing response diversity and developing capabilities for awareness, learning and innovativeness may be a significant step towards this aim.

REFERENCES

ABS 2016, *Glossary*, Australian Bureau of Statistics, viewed 15 March 2016, <http://www.abs.gov.au/Ausstats/abs@.nsf/Previousproducts/8155.0Glossary12009-10?opendocument&tabname=Notes&prodno=8155.0&issue=2009-10&num=&view=>.

Adger, WN 2006, 'Vulnerability', *Global Environmental Change*, vol. 16, no. 3, pp. 268-281.

Akgun, AE & Keskin, H 2014, 'Organisational resilience capacity and firm product innovativeness and performance', *International Journal of Production Research*, vol. 52, no. 23, pp. 6918-6937.

Alaa, G 2009, 'Derivation of factors facilitating organizational emergence based on complex adaptive systems and social autopoiesis theories', *Emergence: Complexity and Organization*, vol. 11, no. 1, pp. 19-34.

Alphaliner 2017, *Alphaliner - Top 100 operated fleets as per 07 January 2017*, Alphaliner, viewed 7 January 2017, <http://www.alphaliner.com/top100/>.

Ambulkar, S, Blackhurst, J & Grawe, S 2015, 'Firm's resilience to supply chain disruptions: Scale development and empirical examination', *Journal of Operations Management*, vol. 33-34, no. 1, pp. 111-122.

AMSA 2016, *ISM Code certification guidelines for regulated Australian vessels*, Australian Maritime Safety Authority, viewed 6 August 2016, <https://www.amsa.gov.au/forms-and-publications/Publications/AMSA422.pdf>.

Anderies, JM, Janssen, MA & Ostrom, E 2004, 'A framework to analyze the robustness of social-ecological systems from an institutional perspective', *Ecology and Society*, vol. 9, no. 1, art 18, pp. 1-18.

Anderson, P 1999, 'Complexity theory and organization science', *Organization Science*, vol. 10, no. 3, pp. 216-232.

Annarelli, A & Nonino, F 2016, 'Strategic and operational management of organizational resilience: current state of research and future directions', *Omega*, vol. 62, pp. 1-18.

Arsovski, S, Stefanović, M, Tadić, D, Aleksić, A & Arsovski, Z 2017, 'Organisational resilience in a cloud-based enterprise in a supply chain: a challenge for innovative SMEs', *International Journal of Computer Integrated Manufacturing*, vol. 30, no. 4-5, pp. 409-419.

Ashby, S & Diacon, S 2000, 'Strategic rivalry and crisis management', *Risk Management: An International Journal*, vol. 2, no. 2, pp. 7-15.

Babbie, ER 2014, *The practice of social research*, 14th edn, Cengage Learning, Boston

Bain, WA 1999, 'Application of theory of action to safety management: recasting the NAT/HRT Debate', *Journal of Contingencies & Crisis Management*, vol. 7, no. 3, pp. 129-140.

Banks, J & Cunningham, S 2016, 'Creative destruction in the Australian videogames industry', *Media International Australia*, vol. 160, no. 1, pp. 127-139.

Bartol, KM 2011, *Management: a Pacific rim focus*, 6th edn, McGraw-Hill Australia, North Ryde.

Berkes, F, Colding, J & Folke, C 2002, 'Introduction', in F Berkes, J Colding & C Folke (eds), *Navigating social ecological systems: building resilience for complexity and change*, Cambridge University Press, Cambridge, pp. 1-30.

Berle, O, Rice, JB, Jr. & Asbjornslett, BE 2011, 'Failure modes in the maritime transportation system: a functional approach to throughput vulnerability', *Maritime Policy and Management*, vol. 38, no. 6, pp. 605-632.

Bhamra, R, Dani, S & Burnard, K 2011, 'Resilience: the concept, a literature review and future directions', *International Journal of Production Research*, vol. 49, no. 18, pp. 5375-5393.

Bhaskar, P, Cahoon, S & Brooks, B 2014, 'Ships of change: why seafaring needs to embrace innovation', in *IAMU AGA 15 conference: looking ahead innovation in maritime education, training and research*, Launceston, pp. 325-334.

Bhaskar, P, Cahoon, S & Chen, S-L 2014, 'Conceptualising a resilience based approach to shipping sustainability', *Review of Integrative Business & Economics Research*, vol. 3, no. 1, pp. 302-314.

BIMCO 2009, *SHIPMAN 2009 standard ship management agreement*, Baltic and International Maritime Council (BIMCO), viewed 10 May 2010, <file:///C:/Users/pbhaskar/Downloads/Sample%20copy%20SHIPMAN%202009.pdf>.

Black, J & La Venture, K 2017, 'The human factor to profitability: people-centered cultures as meaningful organizations', *Journal of Organizational Psychology*, vol. 17, no. 2, pp. 24-34.

Boin, A & McConnell, A 2007, 'Preparing for critical infrastructure breakdowns: the limits of crisis management and the need for resilience', *Journal of Contingencies and Crisis Management*, vol. 15, no. 1, pp. 50-59.

Boin, A & van Eeten, MJG 2013, 'The resilient oganization', *Public Management Review*, vol. 15, no. 3, pp. 429-445.

Bourque, LB & Fielder, EP 2003, *How to conduct telephone surveys*, 2nd edn, SAGE, Thousand Oaks.

Bovaird, T 2008, 'Emergent strategic management and planning mechanisms in complex adaptive systems', *Public Management Review*, vol. 10, no. 3, pp. 319-340.

Braes, B & Brooks, D 2010, *Organisational resilience: a propositional study to understand and identify the essential concepts*, Proceedings of the 3rd Australian Security and Intelligence Conference, Perth, Western Australia.

Branch, AE 2005, *Elements of shipping*, 8th edn, Routledge, London.

Branch, AE & Robarts, M 2014, *Branch's elements of shipping*, 9th edn, Routledge, London.

Brand, FS & Jax, K 2007, 'Focusing the meaning (s) of resilience: resilience as a descriptive concept and a boundary object', *Ecology and Society*, vol. 12, no. 1, art. 23.

Brandon-Jones, E, Squire, B, Autry, C & Peters, K 2014, 'A contingent resource-based perspective of supply chain resilience and robustness', *Journal of Supply Chain Management*, vol. 50, no. 3, pp. 55-73.

Bryman, A 2008, *Social research methods*, 3rd edn, Oxford University Press, Oxford.

Burnard, K & Bhamra, R 2011, 'Organisational resilience: development of a conceptual framework for organisational responses', *International Journal of Production Research*, vol. 49, no. 18, pp. 5581-5599.

Cachia, M & Millward, L 2011, 'The telephone medium and semi-structured interviews: a complementary fit', *Qualitative Research in Organizations & Management*, vol. 6, no. 3, p. 265.

Cahoon, SC 2004, 'Seaport marketing: a census of Australian seaports', PhD thesis, University of Tasmania.

Cahoon, SC, Haugstetter, H & Bhaskar, PR 2010, 'Overcoming seafarer shortages: human resource management and marketing strategies for a sustainable future', in *IAME 2010*, Lisbon, pp. 1-12.

Carpenter, S, Walker, B, Anderies, JM & Abel, N 2001, 'From metaphor to measurement: resilience of what to what?', *Ecosystems*, vol. 4, no. 8, pp. 765-781.

Caschili, S & Medda, FR 2012, 'A review of the maritime container shipping industry as a complex adaptive system', *Interdisciplinary Description of Complex Systems*, vol. 10, no. 1, pp. 1-15.

Cerullo, V & Cerullo, MJ 2004, 'Business continuity planning: A comprehensive approach', *Information Systems Management*, vol. Summer 2004, pp. 70-78.

Christopher, M & Peck, H 2004, 'Building the resilient supply chain', *International Journal of Logistics Management*, vol. 15, no. 2, pp. 1-13.

Clark, VLP & Badiee, M 2010, 'Chapter 12: Research questions in mixed methods research', in A Tashakkori & C Teddlie (eds), *Sage handbook of mixed methods in social & behavioral research*, 2nd edn, SAGE Publications, Los Angeles.

Comfort, LK, Sungu, Y, Johnson, D & Dunn, M 2001, 'Complex systems in crisis: anticipation and resilience in dynamic environments', *Journal of Contingencies and Crisis Management*, vol. 9, no. 3, pp. 144-158.

Commonwealth of Australia 2012, *Research paper 1: CEO perspectives on organisational resilience*, Attorney-General's Department, Government of Australia.

Cooke, DL & Rohleder, TR 2006, 'Learning from incidents: from normal accidents to high reliability', *Systems Dynamics Review*, vol. 22, no. 3, pp. 213-239.

Coutu, DL 2002, 'How resilience works', *Harvard Business Review*, vol. 80, no. 5, pp. 46-56.

Creswell, JW & Plano Clark, VL 2007, *Designing and conducting mixed methods research*, SAGE Publications, Thousand Oaks, California.

Cumming, GS, Barnes, G, Perz, S, Schmink, M, Sieving, KE, Southworth, J, Binford, M, Holt, RD, Stickler, C & Van Holt, T 2005, 'An exploratory framework for the empirical measurement of resilience', *Ecosystems*, vol. 8, no. 8, pp. 975-987.

Dahms, T 2010, 'Resilience and risk management', *The Australian Journal of Emergency Management*, vol. 25, no. 2, pp. 21-26.

Dalziell, EP & McManus, ST 2004, 'Resilience, vulnerability and adaptive capacity: implications for systems performance', in *International Forum for Engineering Decision Making*, Stoos, Switzerland.

Darnhofer, I, Bellon, S, Dedieu, B & Milestad, R 2010, 'Adaptiveness to enhance the sustainability of farming systems a review', *Agronomy for Sustainable Development*, vol. 30, no. 3, pp. 545-555.

Darnhofer, I, Fairweather, J & Moller, H 2010, 'Assessing a farm's sustainability: insights from resilience thinking', *International Journal of Agricultural Sustainability*, vol. 8, no. 3, pp. 186-198.

De Leeuw, E, Callegaro, M, Hox, J, Korendijk, E & Lensvelt-Mulders, G 2007, 'The influence of advance letters on response in telephone surveys: a meta-analysis', *Public Opinion Quarterly*, vol. 71, no. 3, pp. 413-443.

De Monie, G, Rodrigue, J-P & Notteboom, T 2011, "Economic cycles in maritime shipping and ports: the path to the crisis of 2008", in P Hall, RJ McCalla, C Comtois & B Slack (eds), *Integrating seaports and trade corridors*, Ashgate Publishing Limited, Farnham, pp. 13-30.

De Wolf, T & Holvoet, T 2005, 'Emergence versus self-organisation: different concepts but promising when combined', *Engineering Self-Organising Systems: Methodologies and Applications*, vol. 3464, pp. 1-15.

Devlin, ES 2007, *Crisis management planning and execution*, Auerbach Publications, Boca Raton.

Dillman, DA, Smyth, JD & Christian, LM 2009, *Internet, mail, and mixed-mode surveys: the tailored design method*, Wiley & Sons, Hoboken, NJ.

Dillman, DA, Smyth, JD & Christian, LM 2014, *Internet, phone, mail and mixed-mode surveys*, 4th edn, Wiley, Hoboken.

Duijnhoven, H & Neef, M 2014, 'Framing resilience from a model-based approach to a management process', *Procedia Economics and Finance*, vol. 18, pp. 425-430.

Elliott, D, Swartz, E & Herbane, B 2010, *Business continuity management a crisis management approach*, 2nd edn, Routledge, New York.

Endsley, MR 1995, 'Toward a theory of situation awareness in dynamic systems', *Human Factors*, vol. 37, no. 1, pp. 32-64.

Espinosa, A & Porter, T 2011, 'Sustainability, complexity and learning: insights from complex systems approaches', *Learning Organization*, vol. 18, no. 1, pp. 54-72.

Faulkner, B 2001, 'Towards a framework for tourism disaster management', *Tourism Management*, vol. 22, no. 2, pp. 135-147.

Fiksel, J 2003, 'Designing resilient, sustainable systems', *Environmental Science and Technology*, vol. 37, no. 23, pp. 5330-5339.

Fink, A 2003, *The survey kit*, 2nd edn, Sage Publications, Thousand Oaks.

Fischbacher-Smith, D 2010, 'Beyond the worst case scenario: managing the risks of extreme events', *Risk Management*, vol. 12, no. 1, pp. 1-8.

Fischer, A, Nokhart, H, Olsen, H, Fagerholt, K, Rakke, JG & Stålhane, M 2016, 'Robust planning and disruption management in roll-on roll-off liner shipping', *Transportation Research Part E: Logistics and Transportation Review*, vol. 91, no. Supplement C, pp. 51-67.

Fischer, K & Zink, KL 2012, 'Defining elements of sustainable work systems - a system oriented approach', *Work-a Journal of Prevention Assessment & Rehabilitation*, vol. 41, pp. 3900-3905.

Folke, C 2006, 'Resilience: the emergence of a perspective for social–ecological systems analyses', *Global Environmental Change*, vol. 16, no. 3, pp. 253-267.

Folke, C, Carpenter, SR, Walker, B, Scheffer, M, Chapin, T & Rockström, J 2010, 'Resilience thinking: integrating resilience, adaptability and transformability', *Ecology and Society*, vol. 15, no. 4, art 20, pp. 1-9.

Friedman, M 2005, 'Organisational resilience', *Accountancy SA*, vol. August, p. 24.

Fusillo, M 2006, 'Some notes on structure and stability in liner shipping', *Maritime Policy and Management*, vol. 33, no. 5, pp. 463-475.

Gallopín, GC 2006, 'Linkages between vulnerability, resilience, and adaptive capacity', *Global Environmental Change*, vol. 16, no. 3, pp. 293-303.

Garvin, DA 1993, 'Building a learning organization', *Harvard Business Review*, vol. 71, no. 4, pp. 78-91.

Garvin, DA, Edmondson, AC & Gino, F 2008, 'Is yours a learning organization?', *Harvard Business Review*, vol. 86, no. 3, pp. 109-116.

Gephart, RP 2004, 'Normal risk: technology, sense making, and environmental disasters', *Organization and Environment*, vol. 17, no. 1, pp. 20-26.

Giannakopoulou, EN, Thalassinos, EI & Stamatopoulos, TV 2016, 'Corporate governance in shipping: an overview', *Maritime Policy & Management*, vol. 43, no. 1, pp. 19-38.

Goldspink, C, Kay, R & Hills, B 2010, 'Risk practitioners theories of risk and organisational vulnerability', *Keeping Good Companies*, vol. June, pp. 272-286.

Goulielmos, AM 2002, 'Complexity theory applied to management of shipping companies', *Maritime Policy & Management*, vol. 29, no. 4, pp. 375-391.

Gray, DE 2013, *Doing research in the real world*, 3rd edn, SAGE Publications Ltd, London.

Grewal, D 2008, 'International ship safety regulations', in WK Talley (ed.), *Maritime safety, security and piracy*, Informa Law, London, pp. 11-29.

Groves, RM 2002, 'Research on survey data quality', in DA de Vaus (ed.), *Social surveys: Sage benchmarks in social research methods*, SAGE Publications, London, vol. 2.

Gunderson, LH 2000, 'Ecological resilience--in theory and application', *Annual Review of Ecology and Systematics*, vol. 31, pp. 425-439.

Gurning, S & Cahoon, S 2011, 'Analysis of multi-mitigation scenarios on maritime disruptions', *Maritime Policy and Management*, vol. 38, no. 3, pp. 251-268.

Haimes, YY 2006, 'On the definition of vulnerabilities in measuring risks to infrastructure', *Risk Analysis*, vol. 26, no. 2, pp. 293-296.

Hamel, G & Välikangas, L 2003, 'The quest for resilience', *Harvard Business Review*, vol. 81, no. 9, pp. 52-65.

Hammer, RJ, Edwards, JS & Tapinos, E 2012, 'Examining the strategy development process through the lens of complex adaptive systems theory', *Journal of the Operational Research Society*, vol. 63, no. 7, pp. 909-919.

Harrald, JR 1998, 'A strategic framework for corporate crisis management', in *The International Emergency Management Conference 1998 (TIEMS'98)* Washington DC.

Harrison, I 2008, 'Bulk carrier loading rates', *BIMCO Bulletin*, vol. 103, no. 3, pp. 58-60.

Harvey, WS 2011, 'Strategies for conducting elite interviews', *Qualitative Research*, vol. 11, no. 4, pp. 431-441.

Ho, M, Teo, STT, Bentley, T, Verreyne, M-L & Galvin, P 2014, 'Organisational resilience and the challenge for human resource management: conceptualizations and frameworks for theory and practice', paper presented to *4th annual international conference on human resource management & professional development for the digital age*, Singapore.

Hohenstein, N-O, Feisel, E, Hartmann, E & Giunipero, L 2015, 'Research on the phenomenon of supply chain resilience: A systematic review and paths for further investigation', *International Journal of Physical Distribution & Logistics Management*, vol. 45, no. 1/2, pp. 90-117.

Holland, JH 1992, 'Complex adaptive systems', *Daedalus*, vol. 121, no. 1, pp. 17-30.

Holling, CS 1973, 'Resilience and stability of ecological systems', *Annual Review of Ecology and Systematics*, vol. 4, pp. 1-23.

Holling, CS 1996, 'Engineering resilience versus ecological resilience', in *Engineering Within Ecological Constraints*, The National Academy of Sciences, pp. 31-43.

Holling, CS 2001, 'Understanding the complexity of economic, ecological, and social systems', *Ecosystems*, vol. 4, no. 5, pp. 390-405.

Hollnagel, E 2014, 'Resilience engineering and the built environment', *Building Research & Information*, vol. 42, no. 2, pp. 221-228.

Hopkin, P 2014, 'Achieving enhanced organisational resilience by improved management of risk: summary of research into the principles of resilience and the practices of resilient organisations', *Journal of Business Continuity & Emergency Planning*, vol. 8, no. 3, pp. 252-262.

ICS 2005, *Introduction to shipping*, Witherby for the Institute of Chartered Shipbrokers, London.

ICS 2017, *2017 Annual review*, International Chamber of Shipping, London.

INTERCARGO 2016, *The dry cargo trades*, International Association of Dry Cargo Ship Owners, viewed 19 November 2016, <http://www.intercargo.org/en/about-us/the-dry-cargo-industry.html#the-dry-cargo-trades>.

Jansen, C, Cammock, P & Conner, L 2011, 'Leadership for emergence: exploring organisations through a living system lens', *Leading & Managing*, vol. 17, no. 1, pp. 59-74.

Kaiser, K 2009, 'Protecting respondent confidentiality in qualitative research', *Qualitative Health Research*, vol. 19, no. 11, pp. 1632-1641.

Kamalahmadi, M & Parast, M 2016, 'A review of the literature on the principles of enterprise and supply chain resilience: Major findings and directions for future research', *International Journal of Production Economics*, vol. 171, no. 1, pp. 116-133.

Kay, R & Goldspink, C 2012, *CEO perspectives on organisational resilience*, Research Paper 1, Commonwealth of Australia.

Kelly, M & McMullan, C 2012, 'Building resilience through effective business continuity management: Sharing good practice from an Irish context', *Emergency Management Review*, vol. 1, no. 1, pp. 42 - 61.

Kerr, H 2016, 'Organizational resilience', *Quality*, vol. 55, no. 7, pp. 40-43.

Klockner, K 2017, 'Developing organisational resilience: organisational mindfulness and mindful organising', paper presented to Australian and New Zealand disaster and emergency management conference, May 22-23, 2017, Gold Coast.

Kolay, MK 2016, 'Measurement of organizational resilience: an approach', *Productivity*, vol. 57, no. 3, pp. 300-309.

Komlos, J 2016, 'Has creative destruction become more destructive?', *B.E. Journal of Economic Analysis & Policy*, vol. 16, no. 4, pp. 1-12.

Kou, Y & Luo, M 2016, 'Strategic capacity competition and overcapacity in shipping', *Maritime Policy & Management*, vol. 43, no. 4, pp. 389-406.

Kristiansen, S 2005, *Maritime transportation safety management and risk analysis*, Elsevier Butterworth-Heinemann, Oxford.

Kumar, R 2014, *Research methodology: a step-by-step guide for beginners*, 4th edn, SAGE Publications, Los Angles.

La Porte, TR & Consolini, P 1998, 'Theoretical and operational challenges of "high reliability organisations": air-traffic control and aircraft carriers', *Journal of Public Administration*, vol. 21, no. 6-8, pp. 847-852.

Lagadec, P 1997, 'Learning processes for crisis management in complex organizations', *Journal of Contingencies & Crisis Management*, vol. 5, no. 1, pp. 24-31.

Lalonde, C 2011, 'Managing crises through organisational development: a conceptual framework', *Disasters*, vol. 35, no. 2, pp. 443-464.

Lam, JSL & Bai, X 2016, 'A quality function deployment approach to improve maritime supply chain resilience', *Transportation Research Part E: Logistics and Transportation Review*, vol. 92, pp. 16-27.

Lansing, JS 2003, 'Complex adaptive systems', *Annual Review of Anthropology*, vol. 32, pp. 183-204.

Leana, CR & Van Buren III, HJ 1999, 'Organizational social capital and employment practices', *Academy of Management Review*, vol. 24, no. 3, pp. 538-555.

Lee, AV, Vargo, J & Seville, E 2013, 'Developing a tool to measure and compare organizations' resilience', *Natural Hazards Review*, vol. 14, no. 1, pp. 29-41.

Lengnick-Hall, CA, Beck, TE & Lengnick-Hall, ML 2011, 'Developing a capacity for organizational resilience through strategic human resource management', *Human Resource Management Review*, vol. 21, no. 3, pp. 243-255.

Leonard, HB & Howitt, AM 2012, 'Leading in crises: observations on the political and decision-making dimensions of response', in I Helsloot, A Boin & LK Comfort (eds), *Mega-crises: understanding the prospects, nature, characteristics and the effects of cataclysmic events*, Charles C. Thomas, Springfield, IL.

Leveson, N, Dulac, N, Marais, K & Carroll, J 2009, 'Moving beyond normal accidents and high reliability organizations: a systems approach to safety in complex systems', *Organization Studies*, vol. 30, no. 2-3, pp. 227-249.

Levin, SA & Lubchenco, J 2008, 'Resilience, robustness, and marine ecosystem-based management', *Bioscience*, vol. 58, no. 1, pp. 27-32.

Lind, DA, Marchal, WG & Wathen, SA 2015, *Statistical techniques in business & economics*, 16th edn, McGraw-Hill Education, New York.

Linnenluecke, MK 2017, 'Resilience in business and management research: a review of influential publications and a research agenda', *International Journal of Management Reviews*, vol. 19, pp. 4-30.

Lirn, T-C & Shang, K-C 2015, 'An empirical survey on port risk management in the Kaohsiung port', *Journal of the Eastern Asia Society for Transportation Studies*, vol. 11, pp. 2277-2295.

LLA 2016, *Directory of Maritime and Logistics Services*, Lloyd's List Australia, viewed 16 April 2016, <http://directory.lloydslistaustralia.com.au/lldcn/australian_shipping_air_road_rail_services_directory>.

Lorange, P 2005, *Shipping company strategies: global management under turbulent conditions*, Elsevier, Oxford.

Lutzhoft, M, Jones, BS, Earthy, JV & Bergquist, C 2006, 'Making safety by tying the knot: examining resilience in shipping', in *Proceedings of the 2nd symposium on resilience engineering*, Juan-les-Pins, pp. 8-10.

Mackay, P 2008, 'Observing the correct procedures', *Lloyd's List TT Club Special Issue IS 40*, pp. 16-17.

Madni, AM & Jackson, S 2009, 'Towards a conceptual framework for resilience engineering', *Systems Journal, IEEE*, vol. 3, no. 2, pp. 181-191.

Malbon, J & Bishop, B 2006, *Australian export: a guide to law and practice*, Cambridge University Press, New York.

Mamouni Limnios, EA, Mazzarol, T, Ghadouani, A & Schilizzi, SGM 2014, 'The resilience architecture framework: four organizational archetypes', *European Management Journal*, vol. 32, no. 1, pp. 104-116.

Manyana, SB 2006, 'The concept of resilience revisited', *Disasters*, vol. 30, no. 4, pp. 433-450.

Marine Insight 2017, Marine Insight, viewed 3 July 2017, <http://www.marineinsight.com/>.

Martin-Breen, P & Anderies, JM 2011, *Resilience: a literature review*, The Rockefeller Foundation.

Mason, R & Nair, R 2013, 'Strategic flexibility capabilities in the container liner shipping sector', *Production Planning & Control*, vol. 24, no. 7, pp. 640-651.

Maxwell, J, Chmiel, M & Rogers, SE 2015, 'Chapter 13: designing integration in multimethod and mixed method research', in SN Hesse-Biber & B Johnson (eds), *The Oxford handbook of multimethod and mixed methods research inquiry*, Oxford University Press, Oxford, pp. 223-239.

McDaniel, RR 2007, 'Management strategies for complex adaptive systems sensemaking, learning and improvisation', *Performance Improvement Quarterly*, vol. 20, no. 2, pp. 21-41.

McDonald, N 2006, 'Organisational resilience and industrial risk', in E Hollnagel, DD Woods & N Leveson (eds), *Resilience engineering concepts and precepts*, Ashgate Publishing Limited, Aldershot, Hampshire, pp. 155-180.

McKenzie, F 2014, *Complex adapative systems: implications for leaders, organisations, government and citizens*, Australian Futures Project, La Trobe University.

McManus, ST 2008, 'Organisational resilience in New Zealand', PhD thesis, University of Canterbury.

MIAL 2016, *Maritime Industry Australia Limited*, viewed 14 April 2016, <http://www.asa.com.au/>.

Mikecz, R 2012, 'Interviewing elites: addressing methodological issues', *Qualitative Inquiry*, vol. 18, no. 6, pp. 482-493.

Mitroff, II, Alpaslan, MC & Green, SE 2004, 'Managing crises in the twenty-first century: crises as ill-structured messes', *International Studies Review*, vol. 6, pp. 175-182.

Molina-Azorin, J & Cameron, RA 2015, 'History and emergent practices of multimethod and mixed methods in business research', in S Hesse-Biber & RB Johnson (eds), *The*

Oxford handbook of multimethod and mixed methods research inquiry, Oxford University Press, Oxford, pp. 466-485.

Momani, NM 2010, 'Business continuity planning: are we prepared for future disasters?', *American Journal of Economics and Business Administration*, vol. 2, no. 3, pp. 272 - 279.

Moreira, P 2013, 'The maritime chain as a complex adaptive system', *MPRA Paper No. 50895*, viewed 23 Feb 2014, <http://mpra.ub.uni-muenchen.de/50895/>.

Morton, R 2016, 'Youth 'ill-prepared in work skills of future'', *The Australian*, viewed 21 April 2016, <http://www.theaustralian.com.au/national-affairs/youth-illprepared-in-work-skills-of-future/news-story/e2ce8d7ad9e30006ecc20228c1c9fa76>.

Nandi, A & Platt, L 2017, 'Are there differences in responses to social identity questions in face-to-face versus telephone interviews? Results of an experiment on a longitudinal survey', *International Journal of Social Research Methodology*, vol. 20, no. 2, pp. 151-166.

Normandin, J-M & Therrien, M-C 2016, 'Resilience factors reconciled with complexity: the dynamics of order and disorder', *Journal of Contingencies & Crisis Management*, vol. 24, no. 2, pp. 107-118.

Notteboom, T & Lam, JSL 2014, 'Dealing with uncertainty and volatility in shipping and ports', *Maritime Policy & Management*, vol. 41, no. 7, pp. 611-614.

Omer, M, Mostashari, A, Nilchiani, R & Mansouri, M 2012, 'A framework for assessing resiliency of maritime transportation systems', *Maritime Policy & Management*, vol. 39, no. 7, pp. 685-703.

Oxford Metrica 2015, *The 2015 FM Global resilience index annual report*, Oxford Metrica.

Paley, J 2007, 'Complex adaptive systems and nursing', *Nursing Inquiry*, vol. 14, no. 3, p. 233.

Pallant, J 2016, *SPSS survival manual a step by step guide to data analysis using IBM SPSS*, 6th edn, Allen & Unwin, Sydney.

Palmberg, K 2009, 'Complex adaptive systems as metaphors for organisational management', *The Learning Organisation*, vol. 16, no. 6, pp. 483-498.

Papapostolou, NC, Pouliasis, PK & Kyriakou, I 2017, 'Herd behavior in the drybulk market: an empirical analysis of the decision to invest in new and retire existing fleet capacity', *Transportation Research Part E: Logistics and Transportation Review*, vol. 104, no. Supplement C, pp. 36-51.

Parsons, D 2010, 'Organisational resilience', *The Australian Journal of Emergency Management*, vol. 25, no. 2, pp. 18-20.

Paton, D, Kelly, G & Doherty, M 2006, 'Exploring the complexity of social and ecological resilience to hazards', in D Paton & D Johnston (eds), *Disaster resilience an integrated approach*, Charles C Thomas Publisher Ltd, Springfield, Illinois, pp. 190-212.

Paun, C & Topan, V 2016, 'Capital structure in the global shipping industry', *Panoeconomicus*, vol. 63, no. 3, pp. 359-384.

Pearson, CM & Clair, JA 1998, 'Reframing crisis management', *Academy of Management Review*, vol. 23, no. 1, pp. 59-76.

Pearson, CM & Mitroff, II 1993, 'From crisis prone to crisis prepared: a framework for crisis management', *Executive*, vol. 7, no. 1, pp. 48-59.

Pendall, R, Foster, KA & Cowell, M 2010, 'Resilience and regions : building understanding of the metaphor', *Cambridge Journal of Regions, Economy and Society*, vol. 3, pp. 71-84.

Perrow, C 1984, *Normal accidents: living with high-risk technologies*, Basic Books, New York.

Perrow, C 1994, 'The limits of safety: the enhancement of a theory of accidents', *Jouranl of Contingencies and Crisis Management*, vol. 2, no. 4, pp. 212-220.

Pettit, T, Fiksel, J & Croxton, KL 2010, 'Ensuring supply chain resilience: Development of a conceptual framework', *Journal of Business Logistics*, vol. 31, no. 1, pp. 1-14.

Pollard, D & Hotho, S 2006, 'Crises, scenarios and the strategic management process', *Management Decision*, vol. 44, no. 6, pp. 721-736.

Ponomarov, SY 2012, 'Antecedents and consequences of supply chain resilience: A dynamic capabilities perspective', PhD thesis, University of Tennessee.

Ponomarov, SY & Holcomb, MC 2009, 'Understanding the concept of supply chain resilience', *The International Journal of Logistics Management*, vol. 20, no. 1, pp. 124-143.

Punch, K 2005, *Introduction to social research : quantitative and qualitative approaches*, 2nd edn, SAGE Publications, London.

Puranam, P, Alexy, O & Reitzig, M 2014, 'What's new about new forms of organizing? ', *Academy of Management Review*, vol. 39, no. 2, pp. 162-180.

Quinlan, C, Babin, B, Carr, J & Griffin, M 2015, *Business research methods*, CENGAGE Learning, Andover.

Quinn, JB 1978, 'Strategic change: logical incrementalism', *Sloan Management Review*, vol. Fall, pp. 7-21.

Raye, J 2014, 'Fractal organisation theory', *Journal of Organisational Transformation & Social Change*, vol. 11, no. 1, pp. 50-68.

Rijpma, JA 2003, 'From deadlock to dead end: the normal accidents - high reliability debate revisted', *Journal of Contingencies & Crisis Management*, vol. 11, no. 1, pp. 37-45.

Ritchie, BW 2004, 'Chaos, crises and disasters: a strategic approach to crisis management in the tourism industry', *Tourism Management*, vol. 25, pp. 669-683.

Roberts, KH 1990, 'Managing high reliability organizations', *California Management Review*, vol. 32, no. 4, pp. 101-113.

Roberts, KH, Bea, R & Bartles, DL 2001, 'Must accidents happen? lessons from high-reliability organsiations', *Academy of Management Executive*, vol. 15, no. 3, pp. 70-79.

Roberts, KH & Bea, RG 2002, 'When systems fail', *Organizational Dynamics*, vol. 29, no. 3, pp. 179-191.

Rochlin, GI, La Porte, TR & Roberts, KH 1987, 'The self-designing high-reliability organization: aircraft carrier flight operations at sea', *Naval War College Review*, vol. 51, no. 3, pp. 97-113.

Roe, E & Schulman, PR 2012, 'Toward a comparative framework for measuring resilience in critical infrastructure systems', *Journal of Comparative Policy Analysis: Research and Practice*, vol. 14, no. 2, pp. 114-125.

Ryan, A 2009, 'The foundation for an adaptive approach: insights from the science of complex systems', *Australian Army Journal*, vol. VI, no. 3, pp. 69-90.

Sagan, SD 1993, *The limits of safety: organizations, accidents and nuclear weapons*, Princeton University Press, Princeton, NJ.

Sagan, SD 1994, 'Toward a political theory of organizational reliability', *Journal of Contingencies & Crisis Management*, vol. 2, no. 4, pp. 228-240.

SAL 2016, *Shipping Australia Limited*, viewed 14 April 2016, <https://shippingaustralia.com.au/>.

Sarantakos, S 2013, *Social research*, 4th edn, PALGRAVE MACMILLAN, Basingstoke, Hampshire.

Scheffer, M 2009, *Critical transitions in nature and society*, Princeton University Press, Princeton, New Jersey.

Schneider, M & Somers, M 2006, 'Organizations as complex adaptive systems: implications of complexity theory for leadership research', *The Leadership Quarterly*, vol. 17, pp. 351-365.

Schoon, M 2005, 'A short historical overview of the concepts of resilience, vulnerability, and adaptation', in *Workshop in political theory and policy analysis, Indiana University, working paper W05-4*, vol. 29.

Schulman, P, Roe, E, Eeten, Mv & Bruijne, Md 2004, 'High reliability and the management of critical infrastructures', *Journal of Contingencies and Crisis Management*, vol. 12, no. 1, pp. 14-28.

Senge, PM 1990, *The fifth discipline: the art and practice of the learning organization*, Doubleday, New York

Serrat, O 2013, *On resilient organizations*, Asian Development Bank, Manila.

Seville, E 2017, *Resilient organisations: how to survive, thrive and create opportunities through crisis and change*, Kogan Page, London.

Seville, E, Van Opstal, D & Vargo, J 2015, 'A primer in resiliency: seven principles for managing the unexpected', *Global Business and Organizational Excellence*, vol. 34, no. 3, pp. 6-18.

Sexton, D 2016, *Australia announces IMO candidacy*, Informa, viewed 11 November 2016, <https://www.lloydslistaustralia.com.au/lla/market-sectors/law-and-regulation/Australia-announces-IMO-candidacy-542459.html>.

Sheffi, Y & Rice, JB 2005, 'A supply chain view of the resilient enterprise', *MITSloan Management Review*, vol. 47, no. 1, pp. 40-48.

Shi, W & Li, KX 2017, 'Themes and tools of maritime transport research during 2000-2014', *Maritime Policy and Management*, vol. 44, no. 2, pp. 151-169.

Shin, Y & Thai, VV 2015, 'The impact of corporate social responsibility on customer satisfaction, relationship maintenance and loyalty in the shipping industry', *Corporate Social Responsibility and Environmental Management*, vol. 22, no. 6, pp. 381-392.

Shrivastava, P, Mitroff, II, Miller, D & Miglani, A 1988, 'Understanding industrial crises', *Journal of Management Studies*, vol. 25, no. 2, pp. 283-303.

Simola, SK 2005, 'Organizational crisis management: overview and opportunities', *Consulting Psychology Journal: Practice and Research*, vol. 57, no. 3, pp. 180-192.

Singleton, R & Straits, BC 2010, *Approaches to social research*, 5th edn, Oxford University Press, New York.

Sjöqvist, M & Sorocka, F 2011, *The global shipping industry : a business analysis from 1970 - 2009 of the profitability and sustainability in the shipping industry*, Högskolan i Jönköping, Internationella Handelshögskolan, Sweden, Europe.

Smith, D 2006, 'Crisis management - practice in search of a paradigm', in D Smith & D Elliott (eds), *Key readings in crisis management: systems and structures for prevention and recovery*, Routledge, Abingdon, pp. 1-12.

Smith, D & Fischbacher, M 2009, 'The changing nature of risk and risk management: the challenge of borders, uncertainty and resilience', *Risk Management*, vol. 11, no. 1, pp. 1-12.

Stenval, J & Virtanen, P 2017, 'Intelligent Public Organizations', *Public Organization Review*, vol. 17, no. 2, pp. 195-209.

Stephens, N 2007, 'Collecting data from elites and ultra elites: telephone and face-to-face interviews with macroeconomists', *Qualitative Research*, vol. 7, no. 2, p. 203.

Stephenson, A 2010, 'Benchmarking the resilience of organisations', PhD thesis, University of Canterbury.

Stewart, J & O'Donnell, M 2007, 'Implementing change in a public agency: Leadership, learning and organisational resilience', *International Journal of Public Sector Management*, vol. 20, no. 3, pp. 239-251.

Stopford, M 2009, *Maritime economics*, 3rd edn, Routledge, Abingdon.

Sundstrom, G & Hollnagel, E 2006, 'Learning how to create resilience in business systems', in E Hollnagel, DD Woods & N Leveson (eds), *Resilience engineering: concepts and precepts*, Ashgate Publishing Limited, Aldershot, Hampshire, pp. 235-252.

Sutcliffe, KM & Vogus, TJ 2003, 'Organizing for resilience', in KS Cameron, JE Dutton & RE Quinn (eds), *Positive organizational scholarship: Foundations of a new discipline*, Berret-Koehler Publishers, Inc, San Francisco, pp. 94-110.

Teddlie, C & Tashakkori, A 2009, *Foundations of mixed methods research : integrating quantitative and qualitative approaches in the social and behavioral sciences*, Sage Publications, Thousand Oaks.

Tillement, S, Cholez, C & Reverdy, T 2009, 'Assessing organizational resilience: an interactionist approach', *M@ n@ gement*, vol. 12, no. 4, pp. 230-264.

Trist, E 1981, *The evolution of socio-technical systems: a conceptual framework and an action research program, Occasional paper No. 2 June 1981*, Ontario Quality of Working Life Centre, Ontario.

Uhl-Bien, M, Marion, R & McKelvey, B 2007, 'Complexity leadership theory: shifting leadership from the industrial age to the knowledge era', *The Leadership Quarterly*, vol. 17, no. 4, pp. 298-318.

UNCTAD 2012, *Review of maritime transport 2012, United Nations Publication UNCTAD/RMT/2012*, UNCTAD Secretariat, Geneva.

UNCTAD 2015, *Review of maritime transport 2015, United Nations Publication UNCTAD/RMT/2015*, UNCTAD Secretariat, Geneva.

UNCTAD 2016, *Review of maritime transport 2016, United Nations Publication UNCTAD/RMT/2016*, UNCTAD Secretariat, Geneva.

Välikangas, L 2010, *The resilient organization: how adaptive cultures thrive even when strategy fails*, McGraw-Hill, New York.

Vonck, I & Notteboom, T 2016, 'Panarchy within a port setting', *Journal of Transport Geography*, vol. 51, no. Supplement C, pp. 308-315.

Walker, B, Holling, CS, Carpenter, SR & Kinzig, A 2004, 'Resilience, adaptability and transformability in social-ecological systems', *Ecology and Society*, vol. 9, no. 2, art 5, pp. 1-9.

Walker, B & Salt, D 2006, *Resilience thinking: sustaining ecosystems and people in a changing world*, Island Press, Washington.

Waller, MJ & Roberts, KH 2003, 'High reliability and organizational behavior: finally the twain must meet', *Journal of Organizational Behavior*, vol. 24, no. 7, pp. 813-814.

Walliman, N 2011, *Your research project: designing and planning your work*, 3rd edn, Sage Publications, London.

Walter, M 2013, 'Chapter 6: Surveys', in M Walter (ed.), *Social research methods*, 3rd edn, Oxford University Press, South Melbourne.

Wang, GWY, Woo, S & Mileski, J 2014, 'The relative efficiency and financial risk assessment of shipping companies', *Maritime Policy & Management*, vol. 41, no. 7, pp. 651-666.

Wang, WT 2011, 'System dynamics modelling for examining knowledge transfer during crises', *Systems Research and Behavioral Science*, vol. 28, no. 1, pp. 105-127.

Watts, J 2014, 'The perils of command and control', *Systemic Practice and Action Research*, vol. 27, no. 1, pp. 75-89.

Weick, KE 1984, 'Small wins: redefining the scale of social problems', *American Psychologist*, vol. 39, no. 1, pp. 40-49.

Weick, KE 2010, 'Reflections on enacted sensemaking in the bhopal disaster', *Journal of Management Studies*, vol. 47, no. 3, pp. 537-550.

Weick, KE & Sutcliffe, KM 2008, 'Organizing for higher reliability: lessons learned from wildland firefighters', *Fire Management Today*, vol. 68, no. 2, pp. 14-19.

Wesnser, BS 2015, 'An analysis of reliability and resilience in high reliability teams', *Journal of Management and Marketing Research*, vol. 18, pp. 1-21.

Wheatley, MJ 2008, 'Self-organized networks, what are the leadership lessons?', *Leadership Excellence*, vol. 25, no. 2, pp. 7-8.

White, MWD 2007, *Australasian marine pollution laws*, 2nd edn, Federation Press, Sydney.

Witmer, H & Mellinger, MS 2016, 'Organizational resilience: nonprofit organizations' response to change', *Work-a Journal of Prevention Assessment & Rehabilitation*, vol. 54, no. 2, pp. 255-265.

Wreathall, J 2006, 'Properties of resilient organizations: an initial view', in E Hollnagel, DD Woods & N Leveson (eds), *Resilience engineering concepts and precepts*, Ashgate Publishing Limited, Aldershot, pp. 275-285.

Zikmund, WG, Babin, BJ, Carr, JC & Griffin, M 2013, *Business research methods*, 9th edn, Cengage Learning, Mason, OH.

Zokaei, K, Seddon, J & O'Donovan, B (eds) 2011, *Systems thinking from heresy to practice: public and private sector studies*, Palgrave Macmillan, Basingstoke.

Zsidisin, G & Wagner, S 2010, 'Do perceptions become reality? The moderating role of supply chain resiliency on disruption occurrance', *Journal of Business Logistics*, vol. 31, no. 2, pp. 1-20.

APPENDIX A: SAMPLING FRAME

Shipping company name	Nationality	Australian subsidiary / branch of foreign company	Types of ships*					Number of vessels	Number of employees
			Oil tanker	Bulk carrier	General cargo	Container	Other		
ANL Container Line Pty Ltd	Australia	na				x		see CMA CGM	see CMA CGM
APL Co Pty Ltd	Singapore	APL Lines (Australia)				x		88	5300
ASP Ship Management	Australia	na	x	x			x	33	2700
Austral Asia Line Pty Ltd	Singapore	Branch office			x			18	^
Australian Offshore Solutions Pty Ltd	Australia	na					x	9	^
BBC Chartering	Germany	BBC Chartering Australia Ltd			x			170	400
Bhagwan Marine Pty Ltd	Australia	na					x	150	650
Carnival Corporation	USA/UK	Branch office					x	5#	^
COSCON	China	COSCO Shipping Lines (Oceania) Pty Ltd				x		314	^
CMA CGM Group	France	CMA CGM & ANL Agencies (Australia) Pty Ltd				x	x	450	29000
Corral Line ApS	Denmark	Corral Line Pty Ltd					x	^	^
CSL Group	Canada	CSL Australia Pty Ltd		x				7#	500##
Evergreen Marine Corporation	Taiwan	Evergreen Shipping Agency (Australia) Pty Ltd				x		193	^
Farstad Shipping Group	Norway	Farstad Shipping (Indian Pacific) Pty Ltd					x	56	1500
Fenwick Shipping	Hongkong	Fenwick Shipping Services (Australia) Pty Ltd		x				8	25
Furness Withy Chartering	UK	Furness Withy (Australia) Pty Ltd		x				16	12
Gearbulk	Bermuda	Gearbulk Australasia Pty Ltd		x	x			150	2080
GO Offshore Pty Ltd	Australia	na					x	16	400
Hamburg Sud	Germany	Hamburg Sud Australia Pty Ltd		x		x	x	177	6301
Hapag-Lloyd	Germany	Hapag-Lloyd (Australia) Pty Ltd				x		166	9413
Hyundai Merchant Marine Co Ltd		Branch office	x	x	x	x		130	3000
INCO Ships Pty Ltd	Australia	na		x				4	190
Jebsens	Norway	Jebsens International (Australia) Pty Ltd		x			x	400	8260
Kawasaki Kisen Kaisha ("K" Line)	Japan	"K" Line (Australia) Pty Ltd	x	x	x	x	x	552	716
Lord Howe Island Sea Freight Pty Ltd	Australia	na			x			1	^
Maersk Line	Denmark	Branch office				x		637	33000
Mediterranean Shipping Company	Switzerland	Mediterranean Shipping Company (Aust) Pty Ltd				x		500	60000
Mitsui OSK Lines Ltd (MOL)	Japan	Mitsui OSK Lines (Australia) Pty Ltd				x		78	^

MMA Offshore Vessel Operations Pty Ltd	Australia	na					x	50	650
MUR Shipping Holdings B.V.	Netherlands	MUR Shipping Australia Pty Ltd		x	x			100	170
Neptune Pacific Line	Australia	Neptune Pacific Agency Australia Pty Ltd			x	x		8	250
Oldendorff Carriers	Germany	Branch office		x				650	4000
OOCL	Hongkong	OOCL (Australia) Pty Ltd				x		103	^
Pacific Basin Shipping Ltd	Hongkong	Branch office		x				200	3330
Pacific Forum Lines	see NPL	na			x	x		see NPL	see NPL
Pacific International Lines	Singapore	Pacific Asia Express Pty Ltd			x	x		190	^
Pacific Marine Group	Australia	na					x	8	130
P&O Maritime	UAE	P&O Maritime Australasia	x	x			x	7#	120##
SeaLink Travel Group	Australia	na					x	8	1100
Searoad Ferries	Australia	na					x	3	95
Searoad Shipping Pty Ltd	Australia	na			x			2	430
Sea Swift Pty Ltd	Australia	na			x		x	32	420
Shell	UK	Shell Tankers Australia Pty Ltd	x				x	9#	254##
Smit Lamnalco	Netherlands	Smit Lamnalco Australia Pty Ltd, and Smit Lamnalco Towage (Australia) Pty Ltd					x	225	3000
Stolt-Nielsen Ltd	UK	Stolt-Nielsen Australia Pty Ltd					x	153	5000
Svitzer	Denmark	Svitzer Australia Pty Ltd					X	430	4000
Swire Pacific Offshore	Singapore	Swire Pacific Offshore Pty Ltd					x	80	^
Swire (China Navigation Company Pty Ltd)	Singapore	Branch office		x	x	x		100	450
Teekay Corporation	USA	Teekay Shipping (Australia) Pty Ltd	x	x			x	24#	264##
Tidewater Inc	USA	Tidewater Marine Australia Pty Ltd					x	300	^
Toll ANL Bass Strait Shipping	Australia	na			x			2	^
Toll Energy and Marine Logistics	Australia	na			x			10	^
TT-Line Company Pty Ltd	Australia	na					x	2	550
United Arab Shipping Co (SAG)	Kuwait	United Arab Agencies (Australia) Pty Ltd (Div of Inchcape)				x		50	^
Wallenius Wilhelmsen Logistics	Norway	Wallenius Wilhelmsen Logistics Australia Pty Ltd			x			55	6700
Westug	Australia	na					x	21	190
Yang Ming Marine Transport Group	Taiwan	Yang Ming (Australia) Pty Ltd			x	x		101	^

*Types as per UNCTAD (2016), #Operated from or registered in Australia, ## Australian division, ^Not known

APPENDIX B: COMPANIES EXCLUDED FROM SAMPLING FRAME

Shipping company name	Nationality	Australian agent of foreign company	Types of ships*					Number of vessels	Number of employees	Reason for exclusion
			Oil tanker	Bulk carrier	General cargo	Container	Other			
Adelaide Brighton Cement Ltd	Australia	na		x				1	na	Ship operated by INCO Ships
Consort Express Lines Ltd	PNG	Toll Seacargo Australia			x			15	^	Ships do not service Australia
Dens Ocean Transport and Shipping Pty Ltd	Singapore	^					x	8	^	Operates from Singapore
Hanjin Shipping	South Korea	na		x		x		150	^	Declared bankruptcy September 2016
Hoegh Autoliners	Norway	Seaway Agencies			x			51	^	Represented by Agent
MARFRET	France	Seaway Agencies			x	x		5	165	Represented by Agent
Mariana Express Lines Pty Ltd	Singapore	Pacific Asia Express Pty Ltd				x		11	^	Represented by Agent
Matson	USA	Inchcape Shipping Service			x	x		26		Represented by Agent
North West Shelf Shipping Service Co	Bermuda	na					x	7	^	Ships operated by Shell Tankers Australia
NYK Group	Japan	na	x	x	x	x	x	782	^	Withdrew from Australia in 2016
Pacific Direct Line	Singapore	Pacific Asia Express Pty Ltd				x		14	^	Represented by Agent
Rio Tinto Marine	Singapore	na		x				15	80	Ships managed by ASP Ship Managament and Anglo-Eastern (UK) Ltd
SAL Heavy Lift GmbH	Germany	na			x			15	^	Australian subsidiary closed in 2017. Australian operations handled through Singapore.
Silentworld Shipping and Logistics Pty Ltd	Solomon I	na			x		x	5	^	Compnay does not operate ships in Australia
Sinotrans Container Line	China	Quay Shipping Australia Pty Ltd				x		43	^	Represented by Agent
Sofrana Unilines NZ Ltd	New Zealand	Seaway Agencies			x			8	400	Represented by Agent
Spliethoff	Netherlands	Asiaworld Shipping Services Pty Ltd			x			50	^	Represented by Agent

*Types as per UNCTAD (2016), #Operated from or registered in Australia, ## Australian division, ^Not known

APPENDIX C: INTERVIEW QUESTIONNAIRE

AUSTRALIAN MARITIME COLLEGE
Department of Maritime and Logistics Management
Locked Bag 1397
Launceston 7250
Tasmania

CONFIDENTIAL

2016 Major Study

Managing unexpected disruptions: The resilience of shipping companies in Australia

Document number _____

Date of interview _____ / _____ / 2016

Time interview started _____ am/pm

Time interview ended _____ am/pm

Total length of interview _____ minutes

As much as possible demographic data obtained for Section F prior to interview……. ☐

INTRODUCTION

(Start here for interview commencing at time and date as per STATEMENT A of the confirmatory phone call)

Good morning/afternoon Mr/Ms/Capt _____

I am Prashant Bhaskar from the Australian Maritime College. I am calling in regards to my recent phone call requesting your assistance in conducting a survey of the measures taken by shipping companies to manage unexpected disruptions.

Thanks for agreeing to this interview. You had previously indicated that now would be a good time to conduct the interview. Is this time still convenient?

Yes.☐ *continue*

No...☐ *if no then:*

New time ……

New date …….

(Start here for interview continuing on from confirmatory phone call)

Your opinions are very valuable for this study. However, I'd like to point out that your involvement with this interview is entirely voluntary. At any stage during the interview you can decline to answer any of the questions or terminate the interview. Your responses will be treated confidentially.

(If written consent has been received)

(If written consent has NOT been received)

Before we start the interview, I'd like to check that you have read the consent form that was sent in the email package earlier and that you consent to this interview. Do I have your consent to proceed with this interview?

Yes..☐ *continue*

No...☐ *if no then ask why and reply to their concerns*

If you are agreeable, I'd like to record this interview to maintain accuracy. Do I have your consent to record this interview?

Yes.. ☐ *if yes, start recording. Repeat question to record consent*

No... ☐ *if no, explain as follows:*

Significance of accuracy, risk of misinterpretation. Data will be safely kept confidential. Transcript can be provided if desired.

If still no, seek permission to record the verbal consent. If permission not granted then ask for written consent to be emailed.

Some of the questions require you to refer to the response card that I had sent in the email package earlier. Have you got it at hand? If not, I can email it to you now, or explain what it looks like so you can make your own. OK, we are set for the interview. Please feel free to interrupt me, seek clarification, or add anything to your reply at any stage. *(Go to next page)*	*Yes..* ☐ *continue* No … ☐ *if no then email or explain over phone*

SECTION A: DISRUPTION MANAGEMENT

A.1 Can you please confirm your current job title and the role that you perform in your company?

_____

_____

CEO/MD/ED (please specify)…….☐..... 01

_____

Senior manager (please specify*)*…….☐..... 02

_____

Other (please specify*)*…….☐.....03

_____

A.2 Can you also tell me how long you have worked for this company?

_____

Insert period in A.5, A.6, A.17, and A.18. Then go to A.3.

A.3 Thank you. We will be using the word 'company' a few times during this interview. Can you please clarify whether, when using the word 'company', you will be referring to the whole of your company, a division within the company, a branch, a department, or a subsidiary?

Whole of the company…….☐..... 01

_____

Division (please specify*)*…….☐..... 02

_____

Branch (please specify*)*…….☐..... 03

_____

Department (please specify*)*…….☐..... 04

_____

Subsidiary (please specify*)*……. ☐ …… 05

_____

Other (please specify*)*……. ☐ …… 06

_____

A.4 What does your company do?

_____

_____

_____

A.5 My next question relates to any unexpected disruption that your company may have experienced in the past.

By 'unexpected disruption' I mean any situation that arises unexpectedly and stops the company from carrying out its usual business. The impact of the disruption seriously threatens the viability of the company.

Has your company previously faced an unexpected disruption or disruptions in the past_____*(insert period from A.2)?*

Yes……. ☐ ….. 01

No……. ☐ ….. 02 *If no, go to A.17*

Don't know/unsure……. ☐ …… 03 *If don't know/unsure even after prompt then go to A.17*

(If don't know/unsure, then prompt: has there been any instance in the past where the company's business was seriously impacted by an unexpected event e.g. port strike, shipping accident, regulatory change, competitor's actions, change in market etc.)

A.6 How many unexpected disruptions has the company faced in the past _____*(insert period from A.2)?*

One……. ☐ .01

Two or more (please specify number)……. ☐ .02 _____

A.7 When did the disruption/latest disruption occur?

_____

A.8 How did you first become aware of this disruption?

_____

_____

A.9 What was the impact of this disruption on the company?

_____

_____

_____

_____

_____

_____

A.10 How did your company respond to this disruption?

_____

_____

_____

_____

_____

_____

A.11 Do you know what caused this disruption?

Yes…… ☐ … 01

If no, go to A.13

No…… ☐ .. 02

A.12 Can you please tell me more about the cause of this disruption?

_____

_____

_____

A.13 Are there any lessons to be learnt from this disruption?

Yes…… ☐ .. 01

No…… ☐ .. 02 *If no, go to A.15*

Don't know/unsure…… ☐ .. 03 *If don't know/unsure go to A.15*

A.14 What lessons has the company learnt from this disruption?

_____

_____

_____

_____

_____

A.15 Have any changes been made to your company as a consequence of this disruption?

Yes…… ☐ .. 01

No…… ☐ .. 02 *If no, go to A.17*

Don't know/unsure…… ☐ .. 03 *If don't know/unsure even after prompt then go to A.17*

(If don't know/unsure, then prompt: has there been any change to operational practices, organisational structure, strategic goals etc.)

A.16 Can you tell me more about the changes that have been made to your company as a consequence of this disruption?

_____

_____

_____

_____

_____

_____

_____

A.17 My next question relates to the threat of unexpected disruption that your company may have faced in the past, or is currently facing.

By 'threat of unexpected disruption' I mean a situation whereby the company is aware of events that may potentially cause a disruption, but there is uncertainty about if, when, where, how, and in what shape or form, the disruption might occur.

Is your company currently facing, or has previously faced, the threat of an unexpected disruption or disruptions during the past_____*(insert period from A.2)?*

Yes…… ☐ 01

No…… ☐ 02 | *If no, go to A.29*

Don't know/unsure…… ☐ 03 | *If don't know/unsure even after prompt then go to A.29*

(If don't know/unsure, then prompt: Are you aware of any event e.g. regulatory change, competitor's actions, change in market etc. that may potentially have a serious impact on the company, but you don't know what that impact may be. Hence you can't plan ahead for it)

A.18 How many threats of unexpected disruptions has the company faced in the past _____ *(insert period from A.2)?*

One…… ☐ 01

Two or more (please specify number*)*…… ☐ 02 _____

A.19 When did the <u>threat/latest threat</u> first arise?

_____

A.20 Is the threat still present?

Yes……01 ☐

No……☐….02

A.21 Can you please describe the situation that caused/is causing this threat?

_____

_____

_____

A.22 Why do you regard this situation as a threat to your company?

_____

_____

_____

_____

A.23 How did you first become aware of this threat?

_____

_____

_____

_____

A.24 What was/is your company's response to this threat?

_____

_____

_____

_____

A.25 Are there any lessons your company has learnt from the way it <u>responded/is responding</u> to this threat?

Yes..... ☐ ... 01

No..... ☐ ... 02 *If no, go to A.27*

Don't know/unsure..... ☐ ... 03 *If don't know/unsure go to A.27*

A.26 What are those lessons?

_____

_____

_____

_____

_____

A.27 Have any changes been made to your company as a consequence of this threat?

Yes..... ☐ ... 01

No..... ☐ ... 02 *If no, go to A.29*

Don't know/unsure..... ☐ ... 03 *If don't know/unsure even after prompt then go to A.29*

(If don't know/unsure, then prompt: has there been any change to operational practices, organisational structure, strategic goals etc.)

A.28 What changes have been made to your company as a consequence of this threat?

_____

_____

_____

_____

_____

_____

_____

A.29 Thanks for that. Does your company use any specific measures designed to reduce the likelihood of disruptions occurring unexpectedly?

Yes……..…… ☐ … 01

No……..…… ☐ … 02 *If no, go to A.31*

Don't know/unsure……..…… ☐ … 03 *If don't know/unsure even after prompt then go to A.31*

(If don't know/unsure, then prompt: do you do anything to ensure that warning signals are picked up quickly? Or, the company responds quickly to changing circumstances?)

A.30 ›

_____

_____

_____

_____

_____

_____

A.31 On a scale of 1 – 10, where 1 is the least effective and 10 is the most effective, how would you rate your company's effectiveness in reducing the likelihood of unexpected disruptions generally?

Least effective 1------2-----3-----4-----5-----6-----7-----8-----9-----10 Most effective

A.32 Why did you give this score?

_____

_____

_____

_____

_____

A.33 I have just asked about the likelihood of unexpected disruptions, now I want to ask about the impact of unexpected disruptions. Does your company use any specific measures designed to enable the company to withstand the impact of unexpected disruptions, should they occur?

Yes…… ☐ … 01

No…… ☐ … 02 *If no, go to A.35*

Don't know/unsure…… ☐ … 03 *If don't know/unsure even after prompt then go to A.35*

(If don't know/unsure, then prompt: do you, for example, have back-up systems in place e.g. IT?)

A.34 Can you tell me more about those measures?

_____

_____

_____

_____

_____

_____

A.35 On a scale of 1 – 10, where 1 is least prepared and 10 is most prepared, how would you rate your company's preparedness to withstand the impact of unexpected disruptions?

Least prepared 1------2-----3-----4-----5-----6-----7-----8-----9-----10 Most prepared

A.36 Why did you give this score?

_____

_____

_____

_____

_____

A.37 Do you use the term 'resilience' in your company?

Yes…… ☐ … 01 *If yes, go to question A.39*

No…… ☐ … 02

Don't know/unsure…… ☐ … 03

A.38 Resilience is the extent to which a company is successful in coping with unexpected disruptions or threats. Being successful means that the company is able to avoid disruptions – for example by adapting and changing itself once an unexpected threat is detected – or, if a disruption does occur, the company is able to avoid failure by limiting the impact of the disruption.

Do you use any term in your company that denotes the company's ability to cope with unexpected disruptions or threats?

Yes (Please specify)…… ☐ … 01

_____ *If yes, insert the term in A.39, A.40 and A.41. Then go to A.39.*

No…… ☐ … 02 *If no, go to Section B*

Don't know/unsure…… ☐ … 03 *If don't know/unsure go to Section B*

A.39 Can you briefly explain your understanding of the term resilience/_____ *(insert term from A.38)*?

_____

_____

_____

_____

_____

_____

_____

_____

_____

A.40 How is the term resilience/_____ *(insert term from A.38)* used within your company?

_____

_____

_____

A.41 On a scale of 1 – 10, where 1 is the least resilience/_____ *(insert term from A.38)* and 10 is the most resilience/_____ *(insert term from A.38)*, how would you rate your company's resilience/_____ *(insert term from A.38)*?

Least 1------2-----3-----4-----5-----6-----7-----8-----9-----10 Most

A.42 Why did you give this score?

_____

_____

_____

_____

_____

_____

_____

SECTION B: AWARENESS

My next questions relate to staff and managers' awareness of how the company works, and its environment. Such awareness may influence how staff and managers anticipate and recognise threats and manage disruptions.

I am going to read out a series of statements about activities that may occur in your company. Please indicate how much you agree or disagree with these statements by using the Response Card.

To what extent do you agree that the following activities occur within your company?

		Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
B.1	Staff roles and responsibilities are clearly defined	1	2	3	4	5	0
B.2	Managers' roles and responsibilities are clearly defined	1	2	3	4	5	0
B.3	Managers keep staff updated on company's key performance indicators or KPIs	1	2	3	4	5	0
B.4	Staff performance appraisals are linked to the achievement of strategic objectives	1	2	3	4	5	0
B.5	New staff are mentored	1	2	3	4	5	0
B.6	Staff are regularly rotated around different sections of company	1	2	3	4	5	0
B.7	Staff meetings are held across different sections of company	1	2	3	4	5	0
B.8	Opportunities are provided for staff to collaborate with each other	1	2	3	4	5	0
B.9	Staff attend industry conferences	1	2	3	4	5	0
B.10	Staff attend meetings with industry groups	1	2	3	4	5	0
B.11	Staff are given access to key information sources *(prompt: information sources that need monitoring in order to pick up signals of changing environment e.g. industry newspapers, market intelligence websites)*	1	2	3	4	5	0
B.12	Staff know who the customers are	1	2	3	4	5	0
B.13	Staff know who the suppliers are *(prompt: suppliers are those that provide inputs to enable the shipping service e.g. ports, labour suppliers etc.)*	1	2	3	4	5	0
B.14	Staff are rewarded for reporting threats to the company	1	2	3	4	5	0
B.15	Staff are rewarded for reporting opportunities for the company	1	2	3	4	5	0
B.16	Staff are rewarded for reporting disruptions	1	2	3	4	5	0

B.17	The company is benchmarked against other companies	1	2	3	4	5	0
B.18	Feedback is obtained from customers	1	2	3	4	5	0
B.19	Feedback is obtained from suppliers	1	2	3	4	5	0
B.20	Stakeholders' feedback is shared with staff	1	2	3	4	5	0

B.21 In addition to the activities that I have already mentioned, are there any other activities that take place in your company which influence staff and managers' awareness of how the company works and its operating environment? If so, can you tell me more about these?

_____

_____

_____

_____

_____

_____

_____

_____

SECTION C: LEARNING ABILITY

Next we will move to questions relating to activities that may influence how staff and managers in your company learn to cope with unfamiliar threats. Please view the Response Card to answer these questions.

To what extent do you agree that the following activities occur within your company?

		Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
C.1	Staff are encouraged to talk about problems at work without fear of retribution	1	2	3	4	5	0
C.2	Diversity of opinions is encouraged	1	2	3	4	5	0
C.3	Staff are made aware of the limitations of company contingency plans	1	2	3	4	5	0
C.4	Staff are made aware of the limitations of company risk assessment documents	1	2	3	4	5	0
C.5	Staff can exchange information freely within the company	1	2	3	4	5	0
C.6	Staff are rewarded for sharing new knowledge	1	2	3	4	5	0
C.7	New knowledge is disseminated widely in the company *(prompt: e.g. emails, newsletters, meetings)*	1	2	3	4	5	0
C.8	Staff participate in exercises involving 'what if' scenarios	1	2	3	4	5	0
C.9	Managers participate in exercises involving 'what if' scenarios	1	2	3	4	5	0
C.10	Managers are trained in decision-making techniques under uncertain circumstances	1	2	3	4	5	0
C.11	Staff selection criteria includes the ability to learn	1	2	3	4	5	0
C.12	Staff development activities target learning skills	1	2	3	4	5	0
C.13	Processes exist for systematic review of past failures	1	2	3	4	5	0
C.14	Lessons from past failures are made accessible to staff	1	2	3	4	5	0
C.15	Continuous improvement processes are utilised to build up knowledge	1	2	3	4	5	0

C.16 In addition to the activities that I have already mentioned, are there any other activities that take place in your company which influence how staff and managers learn to cope with unfamiliar threats? If so, can you tell me more about these?

_____

_____

_____

_____

_____

_____

_____

_____

SECTION D: INNOVATIVENESS

Next we will move to questions relating to activities that may influence how your company finds innovative solutions to complex problems that have not been experienced before. Please view the Response Card to answer these questions.

To what extent do you agree that the following activities occur within your organisation?

		Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
D.1	Senior managers articulate a clear vision of the company's future	1	2	3	4	5	0
D.2	Senior managers communicate company's vision to staff	1	2	3	4	5	0
D.3	Senior managers set uncomplicated rules	1	2	3	4	5	0
D.4	Senior managers do not provide detailed work instructions	1	2	3	4	5	0
D.5	Senior managers focus on results	1	2	3	4	5	0
D.6	Senior managers do not enforce strict adherence to company procedures	1	2	3	4	5	0
D.7	Authority is delegated to the lowest qualified level	1	2	3	4	5	0
D.8	Strategic plans are made in consultation with staff	1	2	3	4	5	0
D.9	Strategic plans are evaluated continuously	1	2	3	4	5	0
D.10	Strategic plans are subject to modification at any time	1	2	3	4	5	0
D.11	Staff are rewarded for innovative solutions	1	2	3	4	5	0
D.12	Staff selection criteria includes ability to use initiative	1	2	3	4	5	0
D.13	Staff selection criteria includes problem-solving ability	1	2	3	4	5	0
D.14	Staff development activities target problem-solving skills	1	2	3	4	5	0
D.15	Managers monitor staff workloads to enable time for reflection	1	2	3	4	5	0
D.16	Managers are accessible to staff	1	2	3	4	5	0
D.17	Managers embody organisational values in practice	1	2	3	4	5	0

D.18 In addition to the activities that I have already mentioned, are there any other activities that take place in your company which influence innovation? If so, can you tell me more about these?

_____

_____

_____

_____

_____

_____

_____

_____

SECTION E: ROBUSTNESS

Thanks. We are nearly at the end of the interview. The final series of questions relate to how your company may minimise losses and shorten recovery time following a disruption. Please use the Response Card to answer these questions.

To what extent do you agree that the following activities occur within your company?

		Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
E.1	Written plans exist for crisis management	1	2	3	4	5	0
E.2	Crisis management exercises are practised	1	2	3	4	5	0
E.3	Managers receive crisis management training	1	2	3	4	5	0
E.4	Staff receive crisis management training	1	2	3	4	5	0
E.5	Written plans exist for business continuity	1	2	3	4	5	0
E.6	Business continuity exercises are practised	1	2	3	4	5	0
E.7	Managers receive business continuity training	1	2	3	4	5	0
E.8	Staff receive business continuity training	1	2	3	4	5	0
E.9	Critical back-up resources are maintained	1	2	3	4	5	0
E.10	Staff are trained to perform a variety of tasks	1	2	3	4	5	0
E.11	Front-line staff are empowered to make appropriate decisions as first responders	1	2	3	4	5	0
E.12	Supportive relationships are cultivated with key customers	1	2	3	4	5	0
E.13	Supportive relationships are cultivated with key suppliers	1	2	3	4	5	0
E.14	Supportive relationships are cultivated with key business partners *(prompt: eg other members of alliances or, collaborations*	1	2	3	4	5	0
E.15	Supportive relationships are cultivated with key community groups	1	2	3	4	5	0
E.16	The company does not rely on a single market	1	2	3	4	5	0
E.17	The company's ships are capable of transporting more than one kind of cargo	1	2	3	4	5	0

E.18 In addition to the activities that I have already mentioned, are there other things that your company does to minimise losses and shorten recovery time in case a disruption were to occur? If so, can you tell me more about these?

_____

_____

_____

_____

_____

_____

_____

_____

SECTION F: DEMOGRAPHICS

Thanks. Just before we finish, I would like to confirm some details about your company.

F.1 I want to confirm how many, or what proportion of ships operated by your company are either owned by the company, or chartered, or managed for a 3rd party?

How many are owned by the company… ☐ ..... 01 _____ %/number

How many are chartered by the compan ☐ ..... 02 _____ %/number

How many are managed for a 3rd party… ☐ ..... 03 _____ %/number

How many are others (please specify)….. ☐ ..... 04 _____ %/number

F.2 How many, or what proportion of ships operated by your company operate in the following shipping markets?

Break bulk…… ☐ ..... 01 _____ %/number

Dry bulk…… ☐ ..... 02 _____ %/number

Liquid bulk …… ☐ ..... 03 _____ %/number

Liquefied gas…… ☐ ..... 04 _____ %/number

Container…… ☐ .....05 _____ %/number

RORO…… ☐ .....06 _____ %/number

Livestock…… ☐ .....07 _____ %/number

Passenger (cruise shipping)…… ☐ .....08 _____ %/number

Passenger (ferry incl. ROPAX)…… ☐ .....09 _____ %/number

Heavy lift…… ☐ .....10 _____ %/number

Offshore support…… ☐ .....11 _____ %/number

Deep sea towage…… ☐ .....12 _____ %/number

Harbour services (incl. tugs)…… ☐ .....13 _____ %/number

Other (please specify)…… ☐ ..... 14 _____ %/number

F.3 How many vessels does your company operate?

1 – 9……. ☐ 01

10 – 49…… ……. ☐ 02

50+……. ☐ 03

If the answer is provided in numbers for F.1 or F.2, then go to F.4.

F.4 How many people in total does your company employ?

1 – 19……. ☐ 01

20 – 199……. ☐ 02

200+……. ☐ 03

F.5 How many, or what proportion of people employed by your company perform sea-going jobs?

_____ %/number

SECTION G: Closing statement and question

G.1 This completes my questions for this interview. Do you have any questions or comments about this research or the topics that we discussed?

_____

_____

_____

_____

G.2 Would you like to receive a report on this research when it becomes available?

Yes……..…….☐..... 01

No……..…….☐..... 02

If yes, what email address should I send the report to?

Email address:_____

G.3 Lastly, are there any other matters regarding the shipping industry that would benefit from further research?

_____

_____

_____

_____

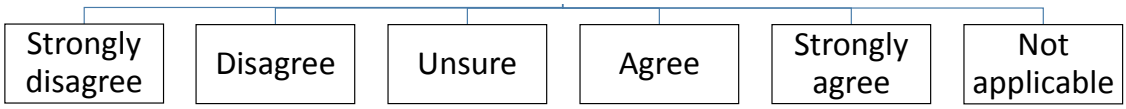
_____

This completes the interview. Thank you very much for your time and assistance with this research. If you know of any other people who may be able to contribute to this study, then please pass on the information that was sent to you so they can contact the investigators if interested.

APPENDIX D: RESPONSE CARD

Response Card (adapted from Cahoon 2004)

Please reply to the interviewer's statements with the response that most closely resembles your opinion on the issue.



There are no right or wrong answers

Only your personal opinion matters

2016 Major study 'Managing unexpected disruptions: the resilience of shipping companies in Australia'

APPENDIX E: ADVANCE LETTER

Advance Letter [not shown on email to respondents]

<Date>

<Title> <First Name> <Last Name>
<Job Title>
<Company>
<Address>
<City>
<State> <Postal Code>

Re: Research study 'Managing unexpected disruptions: the resilience of shipping companies in Australia'

Dear <Title> <Last Name>

We are inviting you to participate in a major study on the resilience of shipping companies in Australia. The purpose of this study is to explore how shipping companies develop resilience capabilities to successfully manage unexpected disruptions to their business. The study is being conducted by the National Centre for Ports and Shipping at the Australian Maritime College, University of Tasmania.

This study seeks input from senior managers of shipping companies. You have been identified as a person whose experience and opinion can provide a valuable contribution to this study.

You are kindly requested to participate in a confidential telephone interview of approximately 30 minutes duration, at a time convenient to you. To assist with the interview, we have enclosed a *Participant Information Sheet*, a *Participant Consent Form* and one *Response Card*.

All information collected will be treated confidentially. Your identity and that of your organisation will not be revealed in any report.

A summary report of the results will be made available to all respondents on request. The report will enable you to benchmark your company against other shipping companies operating in Australia. You may also find the study useful in understanding new practices that may assist in developing strategies for the future. You will be asked during the interview whether you would like the summary of results emailed to you and will not have to request it separately.

This study has been approved by the Tasmanian Social Science Human Research Ethics Committee. The study is being conducted in partial fulfilment of a Doctor of Philosophy degree by Prashant Bhaskar. Within the next week, Prashant will contact you by telephone to ask if you are amenable to an interview. If you have any questions or require additional information about this study, please do not hesitate to contact us through the contact information provided below.

Yours sincerely,

Prashant Bhaskar
Researcher
Master Mariner and Senior Lecturer
National Centre for Ports and Shipping

Dr Stephen Cahoon
Research Supervisor
Director of Research
Sense-T

Dr Peggy Chen
Research Supervisor
Senior Lecturer
National Centre for Ports and Shipping

Locked Bag 1397
Launceston Tasmania 7250
M 04 | E Prashant.Bhaskar@utas.edu.au http://www.amc.edu.au

CRICOS 00586

APPENDIX F: PARTICIPANT INFORMATION SHEET

PARTICIPANT INFORMATION SHEET

SOCIAL SCIENCE/HUMANITIES RESEARCH

Title of project: Managing unexpected disruptions: The resilience of shipping companies in Australia

1. Invitation

You are invited to participate in a major research study into the resilience of shipping companies in Australia. The study is being conducted by Prashant Bhaskar, Senior Lecturer and a PhD candidate at the Australian Maritime College, under the supervision of Dr Stephen Cahoon, Director of Research, Sense-T, and Dr Peggy Chen from the National Centre for Ports and Shipping, Australian Maritime College, University of Tasmania.

2. What is the purpose of this study?

The focus of this study is on the survival, well-being and growth of shipping companies that operate in Australia in a complex and dynamic environment. In particular, this study explores how shipping companies build resilience capabilities to manage unexpected disruptions to their business.

3. Why have I been invited to participate in this study?

You have been invited to participate because of your experience as a senior manager in a company that operates ships in Australia. Your opinions will contribute significantly to this study.

Please note that your involvement with this study is entirely voluntary. There are no consequences if you choose not to participate; it will not affect your relationship with the Australian Maritime College and the University of Tasmania.

4. What will I be asked to do?

We request that you set aside approximately 30 minutes of your time, at your convenience, during which the investigator will telephone you to seek your views on building resilience capabilities in organisations.

For some questions, the investigator will seek your opinion on the basis of a rating scale. To assist in answering such questions, a Response Card has been prepared and sent to you in the email package. Kindly keep this Response Card on hand during the interview to assist you in answering the questions.

At the beginning of the interview, the investigator will seek your consent to make an audio recording of the interview. This is to ensure that the investigator does not misinterpret your answers or rely on memory alone.

5. Are there any possible benefits from participating in this study?

This study will identify the organisational capabilities that enable shipping companies to navigate their way successfully through a volatile and unpredictable environment and will provide a snapshot of current practices. Furthermore, it is anticipated that the findings of this study will result in a set of recommended measures for developing organisational capabilities that enable shipping companies to cope with unexpected disruptions.

The results of this study will provide you with an opportunity to benchmark your own company against other shipping companies operating in Australia. You may also find the study useful in understanding other practices that may assist in developing strategies for the future.

6. Are there any possible risks from participating in this study?

There are no specific risks anticipated with participation in this study.

7. What if I change my mind during or after the study?

You can withdraw your participation from this study at any time without providing an explanation.

8. What will happen to the information when this study is over?

All information will be treated in a confidential manner and your name will not be used in any publication arising out of this research unless with your express agreement. In the final report, you will be referred to by a numeric pseudonym. Any reference to personal information that might allow someone to guess your identity or organisation will be removed. The data will be de-identified before it is analysed. This means that your name and contact details will be kept in a password-protected computer file separate from any information that you provide.

9. How will the results of this study be published?

This study supplies the primary information and data for the student investigator's doctoral thesis. The findings may later be presented or published at conferences and other academic arenas including journals. Copies of such publications can be supplied upon request to any participant in the study.

Upon completion, a summary of the results of this study will be emailed to participants on request. You will be asked during the interview whether you would like the summary of results emailed to you and will not have to request it separately.

10. What if I have questions about this study?

If you would like to discuss any aspects of this study please contact the investigator or any of the chief investigators:

Investigator:
Prashant Bhaskar
Master Mariner and Senior Lecturer
Department of Maritime and Logistics Management
Ph: 04
Email: Prashant.Bhaskar@utas.edu.au

Chief Investigator:
Dr Stephen Cahoon
Director of Research, Sense-T
Ph: 03 6324 9769
Email: stephen.cahoon@utas.edu.au

Chief Investigator:
Dr Peggy Chen
Senior Lecturer
Department of Maritime and Logistics Management
Ph: 03 6324 9694
Email: pchen@utas.edu.au

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03)62266254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H0015948.

Thank you for taking the time to consider this study. This information sheet is for you to keep.

If you agree to take part in this study, please read the attached consent form.

APPENDIX G: PARTICIPANT CONSENT FORM

UNIVERSITY of TASMANIA | AMC Australian Maritime College

Participant Consent Form

Title of project: Managing unexpected disruptions: The resilience of shipping companies in Australia

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves my participation in a telephone interview of approximately 30 minutes duration. The interview will be audio recorded subject to my permission.
5. I understand that participation involves no foreseeable risk.
6. I understand that all research data will be securely stored on the Australian Maritime College, University of Tasmania premises for five years from the publication of the study results, and will then be destroyed.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researcher will maintain confidentiality and that any information I supply to the researcher will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that my participation is voluntary and that I may withdraw at any time without any effect. If I so wish, I may request that any data I have supplied be withdrawn from the research until 31 December 2016.
11. I understand that if I do not provide written consent then I will be asked to provide verbal consent during the interview that will be recorded.

Participant's name: _____

Participant's signature: _____

Date: _____

Statement by Investigator

☐ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name: Prashant Bhaskar

Investigator's signature: _____

Date: _____

APPENDIX H: CONFIRMATORY TELEPHONE CALL DOCUMENT

Confirmatory Telephone Call (adapted from Cahoon 2004)

Telephone Log

Respondent	_____	Date 1:	
Job title	_____		_____/___ ____2016
Company	_____	Time 1:	_____
Telephone	_____		
Mobile	_____	Date 2:	
Email	_____		_____/___ ____2016
		Time 2:	_____

Good morning/afternoon Mr/Ms/Capt _____, this is Prashant Bhaskar from the Australian Maritime College at the University of Tasmania. I recently sent you an email about my research on how shipping companies in Australia manage unexpected disruptions. Did you get a chance to read my email?

[Pause and wait for response]

[If response is NO, offer to ring back later at another time]

[If response is YES, proceed as follows]

The purpose of calling you today is to seek your interest in participating in this major study on how shipping companies in Australia develop capabilities to cope with unexpected adverse situations. Other senior managers of shipping companies in Australia are also being invited to participate.
As I mentioned in my email, in appreciation of your participation, a report will be provided to you on request that will summarise the results of this study. You may find the report useful in benchmarking your company against other companies. You may also find it useful to apply the findings of the study to your own company.
Would you be willing to participate in this important study?

[Pause and wait for response]

[Go to next page]

If respondent says YES	**If respondent says NO**
1. Thank you for agreeing to participate. We can either conduct the interview now, or arrange for another suitable time when I can call you again. Is now a good time for the interview?	1. Is there anyone else in your company who may be interested in participating in this study? YES…. Name: Telephone: Email:

YES…. Go to paragraph 3 of Questionnaire introduction NO…. Go to question 2	Go to **STATEMENT B** NO…. Go to question 2
2. When would be a convenient time for you? Date : _____/_____2016 Respondent's time: _____ My Time :_____	2. Would you be kind enough to answer just 3 quick Yes/No type questions that would contribute to this study? YES…. Go to questions 3 to 5 NO…. Go to **STATEMENT C**
STATEMENT A Thank you for your time. I will call you again on ..... at ……am/pm your time. *[Repeat date and time as agreed above]*	3. Do you use the term 'resilience' within your company? YES NO
	4. Do you employ specific strategies to prepare your company to withstand the impact of unexpected business disruptions? YES NO
	5. Do you employ specific strategies to reduce the likelihood of unexpected business disruptions? YES NO Go to **STATEMENT B**
	STATEMENT B Thank you for your time and valuable contribution to this study.
	STATEMENT C Thank you for your time.

APPENDIX I: PRETEST INVITATION LETTER

Pre-testing Invitation Letter

Thank you for agreeing to pre-test the data collection documents that will be used for the 2016 Major Study: *Managing unexpected disruptions: the resilience of shipping companies in Australia*. I am conducting this study in partial fulfilment of a Doctor of Philosophy degree. I will use your comments to improve the quality of the survey.

The purpose of this study is to explore the strategies used by shipping companies to develop resilience capabilities so as to successfully manage unexpected disruptions to their business. The study will investigate how shipping companies in Australia manage adverse events and circumstances that are difficult to anticipate, and hence prepare for in advance. Data for the research will be collected by interviewing senior managers of companies that operate vessels to provide shipping services in Australia.

Please pre-test the following enclosed documents:

1. The advance letter
2. Participant information sheet
3. Participant consent form
4. Response cards
5. Confirmatory telephone call document
6. Telephone questionnaire labelled 'confidential'

Research questions

The primary research question for this research is:

How can shipping companies develop organisational capabilities for resilience?

The three secondary research questions are:

- *Which organisational capabilities contribute to the resilience of shipping companies?*
- *In what ways do senior managers of shipping companies develop their organisation's capabilities for resilience?*
- *How is organisational resilience characterised by senior managers of shipping companies?*

Interview process

The process for conducting the interviews is:

- An *advance letter* (enclosed) will be emailed to one senior manager of each shipping company in Australia. The potential respondent selected will be the person who manages the operations of their company. In some companies, this person may be the CEO, managing director or executive director.

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- A *participant information sheet*, *participant consent form* and a *response card* (all enclosed) will be attached to the advance letter. The response card will be used for Likert-type questions.
- I will call each potential respondent to arrange a time to conduct the interview. In some cases, the interview may be conducted at the time of the first call if it is convenient to the respondent. I will use the *confirmatory telephone call* document (enclosed) when making the initial call.
- The respondent will not receive a copy of the telephone questionnaire.
- I will be the only person making the phone calls and conducting the interviews.

Telephone questionnaire

On the next page, I have suggested some issues for you to consider when pre-testing the questionnaire. When going through the questionnaire, please note the following:

- The questionnaire is designed as a semi-structured survey instrument.
- The questionnaire is divided into 6 sections: A Disruption management; B Awareness; C Learning capability; D Innovativeness; E Robustness; and F Demographics.
- Words in italics are in smaller font and are either prompts or question routeing comments for me. Furthermore, routeing comments are boxed.
- Underlined pair of words separated by a forward slash indicate that I will be using only one of the two choices during the interview.

Please provide your comments in any way that you see fit. For example, you can either write your comments on the questionnaire itself or send me an email. If you have any questions, please call me on 0419 873 793 or email Prashant.Bhaskar@utas.edu.au.

Please return your comments to me by 18 July 2016.

Once again, I thank you for your valuable time and assistance in improving the questionnaire.
Kind regards
Prashant

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Some issues to consider for pre-testing the questionnaire (adapted from Cahoon 2004)

Layout issues:

1. Do the question numbers flow in chronological order?
2. Are the questions in a logical order?
3. Does the layout of the document make it easy for the interviewer to use?
4. Are the transitions between sections smooth?
5. Are all instructions clear and noticeable for the interviewer?
6. Are there any spelling or grammatical errors?

Completing the questionnaire:

1. How long did the questionnaire take to read through?
2. Are any of the questions unclear or ambiguous?
3. Are any questions difficult to answer?
4. Did you object to answering any of the questions?
5. Is the language appropriate for the proposed sample?
6. Do the filter questions work appropriately?
7. Is the question routeing easy to follow?
8. Is the coding of the responses adequate for use during statistical analysis?
9. Are any questions showing bias?

Purpose of the questionnaire:

1. Do you consider that any major topics have been omitted?
2. Are any of the questions irrelevant and should be omitted?
3. Did you understand the focus of the questionnaire?
4. Are there any other issues you would like to comment on?

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APPENDIX J: RESPONDENT AND COMPANY DETAILS

Respondent and Company Details				
Respondent	Interview duration (mins)	Years in company	F3 Size (no. of vessels)	F4 Size (no. of employees)
CEO, Company #1	37	17.5	3	3
CEO, Company #2	59	7.5	2	3
CEO, Company #3	41	25	1	2
OSM, Company #4	26	5.5	1	3
CEO, Company #5	38	6	1	3
CEO, Company #6	44	30	3	3
OSM, Company #7	32	9	3	3
CEO, Company #8	54	34	2	1
OSM, Company #9	50	2.5	3	3
CEO, Company #10	42	7	3	3
OSM, Company #11	51	1.5	3	3
OSM, Company #12	57	25	3	2
OSM, Company #13	55	10	1	3
OSM, Company #14	45	4	3	3
OSM, Company #15	30	15	3	3
OSM, Company #16	33	0.4	3	3
OSM, Company #17	43	32	1	3
CEO, Company #18	41	5	1	3
OSM, Company #19	43	20	2	3
CEO, Company #20	41	0.6	2	2
OSM, Company #21	36	10	2	3
OSM, Company #22	55	20	3	3
CEO, Company #23	44	43	3	3
CEO, Company #24	38	25	3	3
OSM, Company #25	53	9	1	2
CEO, Company #26	24	20	1	2
CEO, Company #27	28	7	1	2
CEO, Company #28	25	21	1	2
OSM, Company #29	34	20	1	3
OSM, Company #30	35	6	2	3
Mean	41.13	14.6		
Median	41	10		

APPENDIX K: RESPONDENTS' SELF-RATINGS

Respondents' Self-Rating			
	Question number		
Respondent	A31	A35	A41
CEO, Company #1	7	9	8
CEO, Company #2	9	8	9
CEO, Company #3	8	7	7
OSM, Company #4	7	7	8
CEO, Company #5	9	9	8
CEO, Company #6	9	9	8
OSM, Company #7	8	5	6
CEO, Company #8	7	8	7
OSM, Company #9	8	9	6
CEO, Company #10	8	9	7
OSM, Company #11	7	5	8
OSM, Company #12	8	9	9
OSM, Company #13	5	8	6
OSM, Company #14	8	9	8
OSM, Company #15	8	8	9
OSM, Company #16	6	6	3
OSM, Company #17	8	8	8
CEO, Company #18	8	8	7
OSM, Company #19	8	8	9
CEO, Company #20	7	9	6
OSM, Company #21	7	7	8
OSM, Company #22	8	8	8
CEO, Company #23	7	8	8
CEO, Company #24	8	9	9
OSM, Company #25	8	7	8
CEO, Company #26	6	7	8
CEO, Company #27	7	8	8
CEO, Company #28	8	8	7
OSM, Company #29	8	9	7
OSM, Company #30	7	7	9
Mean	**7.57**	**7.87**	**7.57**
Median	**8**	**8**	**8**
Mode	**8**	**8**	**8**
SD	**0.90**	**1.14**	**1.28**

APPENDIX L: LIKERT SCALE DATA

	B. AWARENESS Items																				Mean
Respondent	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	Awareness
CEO, Company #1	5	5	5	4	5	4	4	4	4	4	4	5	4	4	4	4	5	4	4	5	**4.35**
CEO, Company #2	5	5	4	3	4	3	4	5	3	4	5	5	5	4	4	4	4	5	5	4	**4.25**
CEO, Company #3	5	4	4	4	4	4	5	5	4	4	5	4	4	0	4	4	0	4	4	4	**3.80**
OSM, Company #4	4	4	3	2	4	3	2	4	2	2	4	4	2	4	4	4	4	4	4	4	**3.40**
CEO, Company #5	5	5	5	5	4	2	4	5	4	3	4	5	5	4	3	5	5	5	3	5	**4.30**
CEO, Company #6	5	5	4	4	5	2	5	5	4	4	5	5	4	3	4	4	5	5	4	4	**4.30**
OSM, Company #7	5	5	2	4	2	4	4	4	2	4	4	4	4	2	4	4	4	4	4	2	**3.60**
CEO, Company #8	4	2	4	2	4	2	4	4	4	4	4	4	4	2	2	2	0	0	0	4	**2.80**
OSM, Company #9	4	4	4	4	4	2	5	4	4	4	4	5	5	4	4	4	4	5	4	4	**4.10**
CEO, Company #10	5	4	5	4	5	5	5	5	4	4	5	5	4	2	3	2	2	5	4	4	**4.10**
OSM, Company #11	5	5	4	3	4	2	5	5	5	4	4	5	4	3	3	3	5	4	3	2	**3.90**
OSM, Company #12	4	5	4	2	4	4	5	3	5	4	4	5	4	4	5	3	4	4	0	2	**3.75**
OSM, Company #13	4	2	2	2	2	2	2	5	5	5	4	5	3	3	3	2	3	5	3	2	**3.20**
OSM, Company #14	4	5	5	5	4	4	4	4	4	2	4	4	0	0	4	4	4	2	0	4	**3.35**
OSM, Company #15	5	5	4	4	4	4	4	4	2	4	5	5	3	5	5	5	4	5	2	4	**4.15**
OSM, Company #16	4	4	3	3	4	4	5	5	3	5	5	4	4	4	3	4	4	5	3	3	**3.95**
OSM, Company #17	4	5	4	4	4	2	5	5	5	5	5	4	4	5	5	5	5	5	3	4	**4.40**
CEO, Company #18	5	5	5	5	4	4	5	5	4	2	5	5	5	5	4	4	5	5	2	5	**4.45**
OSM, Company #19	5	5	4	5	4	4	4	5	5	5	5	5	5	4	4	4	4	4	4	4	**4.45**
CEO, Company #20	5	5	4	4	3	1	5	5	2	2	4	5	5	4	5	4	3	5	2	5	**3.90**
OSM, Company #21	5	5	5	4	4	2	5	4	5	5	5	5	5	4	4	4	4	4	4	4	**4.35**
OSM, Company #22	5	5	5	5	5	4	2	5	2	3	5	5	5	2	2	2	2	4	4	4	**3.80**
CEO, Company #23	5	5	4	5	5	4	5	5	5	5	4	0	4	4	4	5	4	4	4	4	**4.25**
CEO, Company #24	5	5	4	4	4	4	4	5	4	4	5	5	5	2	2	2	5	5	5	4	**4.15**
OSM, Company #25	5	5	5	5	4	4	5	5	3	3	4	5	5	5	5	5	5	5	5	3	**4.55**
CEO, Company #26	2	2	4	4	4	2	4	4	2	2	5	5	4	4	5	4	2	4	4	4	**3.55**
CEO, Company #27	4	4	2	3	4	2	4	4	2	4	4	5	4	3	4	3	4	5	2	4	**3.55**
CEO, Company #28	4	4	4	4	3	3	5	5	4	4	4	5	5	4	4	3	4	4	4	3	**4.00**
OSM, Company #29	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	**4.95**
OSM, Company #30	4	4	4	4	5	4	5	5	4	4	5	5	5	5	5	4	3	4	4	5	**4.40**
Mean	**4.53**	**4.43**	**4.03**	**3.87**	**4.03**	**3.20**	**4.30**	**4.60**	**3.70**	**3.80**	**4.50**	**4.60**	**4.17**	**3.47**	**3.90**	**3.73**	**3.73**	**4.30**	**3.30**	**3.83**	**4.00**
Median	**5**	**5**	**4**	**4**	**4**	**4**	**4.5**	**5**	**4**	**4**	**4.5**	**5**	**4**	**4**	**4**	**4**	**4**	**4.5**	**4**	**4**	**4.1**
Mode	**5**	**5**	**4**	**4**	**4**	**4**	**5**	**5**	**4**	**4**	**4**	**5**	**4**	**4**	**4**	**4**	**4**	**5**	**4**	**4**	**4.35**
SD	**0.68**	**0.94**	**0.89**	**0.97**	**0.76**	**1.10**	**0.92**	**0.56**	**1.12**	**1.00**	**0.51**	**0.97**	**1.09**	**1.36**	**0.92**	**0.98**	**1.36**	**1.06**	**1.42**	**0.91**	**0.46**

	D. INNOVATIVENESS Items																	Mean
Respondent	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	Innovativeness
CEO, Company #1	5	5	4	4	4	4	4	5	4	5	4	5	5	4	4	4	4	**4.35**
CEO, Company #2	5	5	4	2	5	1	5	1	5	5	4	4	4	5	3	5	4	**3.94**
CEO, Company #3	3	3	4	2	4	2	4	4	4	4	4	4	4	2	4	5	5	**3.65**
OSM, Company #4	4	4	4	4	4	2	4	4	4	4	2	2	2	2	4	5	4	**3.47**
CEO, Company #5	5	4	4	2	5	2	4	4	5	5	4	5	4	5	3	5	5	**4.18**
CEO, Company #6	4	4	5	3	4	1	4	2	4	5	4	5	5	4	4	5	5	**4.00**
OSM, Company #7	2	2	4	4	4	2	3	2	2	2	4	5	4	4	2	5	4	**3.24**
CEO, Company #8	5	5	5	5	5	2	4	5	5	5	2	5	5	5	4	5	5	**4.53**
OSM, Company #9	5	5	4	2	4	2	4	2	4	2	4	4	4	4	2	5	4	**3.59**
CEO, Company #10	5	4	5	4	5	2	4	4	4	4	4	4	5	4	4	5	5	**4.24**
OSM, Company #11	4	5	5	5	4	2	4	4	4	3	4	4	3	3	4	5	4	**3.94**
OSM, Company #12	5	4	3	2	4	2	2	4	4	4	4	5	4	3	4	4	3	**3.59**
OSM, Company #13	3	5	2	4	4	4	2	2	3	3	2	3	3	2	2	4	3	**3.00**
OSM, Company #14	5	5	5	4	4	4	2	2	4	4	4	4	4	4	2	5	5	**3.94**
OSM, Company #15	4	4	4	4	4	2	2	4	5	5	4	4	4	2	2	5	5	**3.76**
OSM, Company #16	4	4	4	4	4	2	2	2	2	4	4	4	3	4	2	4	3	**3.29**
OSM, Company #17	4	4	3	2	4	2	2	2	4	4	4	4	4	4	2	5	4	**3.41**
CEO, Company #18	5	5	4	2	5	2	5	5	4	4	4	2	2	4	4	5	5	**3.94**
OSM, Company #19	5	5	5	4	4	1	4	5	5	4	4	4	4	4	4	5	5	**4.24**
CEO, Company #20	5	5	4	4	4	2	4	5	4	5	4	4	4	2	3	5	5	**4.06**
OSM, Company #21	4	4	5	2	4	1	1	4	4	4	4	4	4	4	5	5	5	**3.76**
OSM, Company #22	4	5	4	5	5	4	5	4	4	4	4	4	4	4	4	5	5	**4.35**
CEO, Company #23	4	4	5	2	5	1	4	5	5	5	4	4	4	4	3	5	4	**4.00**
CEO, Company #24	5	4	4	2	4	2	2	2	4	5	4	4	5	4	4	4	4	**3.71**
OSM, Company #25	5	4	4	4	5	2	4	3	5	4	5	5	5	2	5	5	4	**4.18**
CEO, Company #26	1	2	5	4	5	4	5	2	4	4	4	4	2	2	1	5	5	**3.47**
CEO, Company #27	4	4	4	4	3	3	4	4	4	4	4	4	5	5	3	4	4	**3.94**
CEO, Company #28	4	4	4	4	3	2	4	4	4	4	3	4	4	3	3	4	4	**3.65**
OSM, Company #29	5	5	5	5	5	1	4	4	4	4	5	5	5	5	5	5	5	**4.53**
OSM, Company #30	5	5	5	4	4	2	2	2	3	5	5	5	5	3	3	5	5	**4.00**
Mean	**4.27**	**4.27**	**4.23**	**3.43**	**4.27**	**2.17**	**3.47**	**3.40**	**4.03**	**4.13**	**3.87**	**4.13**	**4.00**	**3.57**	**3.30**	**4.77**	**4.40**	**3.86**
Median	**4.5**	**4**	**4**	**4**	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**3.5**	**5**	**4.5**	**3.94**
Mode	**5**	**4**	**4**	**4**	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**5**	**5**	**3.94**
SD	**0.98**	**0.83**	**0.73**	**1.10**	**0.58**	**0.95**	**1.14**	**1.25**	**0.76**	**0.82**	**0.73**	**0.78**	**0.91**	**1.04**	**1.06**	**0.43**	**0.67**	**0.38**

	C. LEARNING Items															Mean
Respondent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	Learning
CEO, Company #1	5	4	4	4	5	4	5	4	4	4	4	5	4	4	5	**4.33**
CEO, Company #2	5	5	4	4	5	4	5	5	5	4	4	5	5	5	5	**4.67**
CEO, Company #3	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	**4.07**
OSM, Company #4	4	4	4	4	2	4	2	4	4	4	2	2	2	2	4	**3.20**
CEO, Company #5	5	5	3	4	5	4	5	5	5	4	4	5	5	3	5	**4.47**
CEO, Company #6	5	5	1	2	4	5	4	2	4	4	4	5	4	3	5	**3.80**
OSM, Company #7	4	5	2	2	4	2	4	2	4	2	4	2	4	2	4	**3.13**
CEO, Company #8	5	5	0	4	4	2	4	2	2	2	5	4	4	5	5	**3.53**
OSM, Company #9	4	3	2	2	4	4	5	4	4	2	4	4	4	4	5	**3.67**
CEO, Company #10	5	4	4	5	5	2	3	2	2	2	5	4	4	4	4	**3.67**
OSM, Company #11	5	5	2	2	5	4	4	4	5	4	4	4	3	4	4	**3.93**
OSM, Company #12	5	4	2	4	5	4	5	4	5	3	4	4	4	5	4	**4.13**
OSM, Company #13	4	4	2	2	4	3	2	2	4	2	3	4	4	4	4	**3.20**
OSM, Company #14	4	4	2	2	4	4	4	2	2	2	4	4	2	2	2	**2.93**
OSM, Company #15	4	4	2	4	5	4	4	2	2	2	5	4	5	3	2	**3.47**
OSM, Company #16	2	4	3	2	3	4	4	2	2	4	4	4	4	3	3	**3.20**
OSM, Company #17	5	5	3	2	5	5	5	4	4	2	2	4	4	4	4	**3.87**
CEO, Company #18	5	5	4	4	5	5	4	5	5	4	2	4	4	2	5	**4.20**
OSM, Company #19	4	5	4	4	5	4	4	4	4	4	4	4	5	5	5	**4.33**
CEO, Company #20	4	4	4	4	5	4	4	3	4	2	4	2	2	3	4	**3.53**
OSM, Company #21	5	5	4	4	5	4	4	2	2	2	4	4	5	5	5	**4.00**
OSM, Company #22	5	5	3	2	5	2	4	2	4	2	3	4	2	2	2	**3.13**
CEO, Company #23	5	5	4	5	5	4	5	3	4	4	5	5	4	4	5	**4.47**
CEO, Company #24	4	4	4	4	4	2	5	2	2	2	5	4	5	2	4	**3.53**
OSM, Company #25	4	5	2	2	4	5	4	4	5	3	4	4	5	4	5	**4.00**
CEO, Company #26	5	5	4	2	5	4	4	2	2	1	4	2	2	4	4	**3.33**
CEO, Company #27	4	4	3	4	3	3	4	4	4	4	4	3	3	3	4	**3.60**
CEO, Company #28	4	5	4	4	4	3	4	4	4	2	4	4	4	4	5	**3.93**
OSM, Company #29	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	**4.93**
OSM, Company #30	4	4	4	5	5	4	2	4	4	4	4	4	3	3	4	**3.87**
Mean	**4.43**	**4.50**	**3.10**	**3.37**	**4.43**	**3.73**	**4.07**	**3.27**	**3.70**	**3.00**	**3.93**	**3.93**	**3.83**	**3.57**	**4.20**	**3.80**
Median	**4.5**	**5**	**3.5**	**4**	**5**	**4**	**4**	**4**	**4**	**3**	**4**	**4**	**4**	**4**	**4**	**3.83**
Mode	**5**	**5**	**4**	**4**	**5**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**5**	**3.2**
SD	**0.68**	**0.57**	**1.16**	**1.10**	**0.77**	**0.94**	**0.87**	**1.14**	**1.12**	**1.08**	**0.83**	**0.91**	**1.02**	**1.04**	**0.92**	**0.50**

	E: ROBUSTNESS Items																	Mean
Respondent	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	Robustness
CEO, Company #1	4	4	2	5	4	4	4	4	4	4	5	4	4	4	0	4	4	**3.76**
CEO, Company #2	5	5	5	4	5	4	4	3	5	5	5	5	5	5	5	5	5	**4.71**
CEO, Company #3	4	2	2	2	4	2	4	4	4	5	5	4	4	4	4	4	5	**3.71**
OSM, Company #4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	**4.06**
CEO, Company #5	5	5	5	5	5	5	5	4	5	5	4	5	5	5	5	5	5	**4.88**
CEO, Company #6	5	4	4	4	4	4	3	3	5	5	5	5	5	4	4	5	5	**4.35**
OSM, Company #7	2	2	2	2	2	2	2	2	5	4	4	5	5	5	5	4	5	**3.41**
CEO, Company #8	1	1	1	1	1	1	1	1	4	4	5	5	5	5	2	5	5	**2.82**
OSM, Company #9	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	0	**4.12**
CEO, Company #10	5	4	2	1	5	5	2	4	5	5	3	5	5	5	2	5	5	**4.00**
OSM, Company #11	4	3	3	2	4	2	4	2	4	4	4	5	3	5	3	5	5	**3.65**
OSM, Company #12	4	4	4	2	3	4	4	2	4	4	2	4	4	4	3	5	5	**3.65**
OSM, Company #13	5	5	2	2	2	2	2	2	4	2	5	5	4	5	3	5	5	**3.53**
OSM, Company #14	4	4	4	4	4	4	4	4	4	4	4	4	0	4	0	2	4	**3.41**
OSM, Company #15	4	2	2	2	4	2	2	2	4	4	4	5	4	5	3	5	5	**3.47**
OSM, Company #16	4	3	3	3	4	3	3	3	4	4	2	4	4	4	4	4	2	**3.41**
OSM, Company #17	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	**3.82**
CEO, Company #18	4	2	4	2	5	2	4	2	4	4	4	5	4	5	4	4	4	**3.71**
OSM, Company #19	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	**4.82**
CEO, Company #20	5	5	4	2	5	5	5	2	3	4	5	5	4	4	4	5	0	**3.94**
OSM, Company #21	4	5	2	2	4	4	2	2	4	4	4	5	4	4	4	4	4	**3.65**
OSM, Company #22	4	2	2	2	3	2	2	2	4	4	4	5	5	5	3	5	5	**3.47**
CEO, Company #23	5	4	4	4	4	5	5	5	5	5	5	4	4	4	4	4	5	**4.47**
CEO, Company #24	5	5	4	2	5	4	4	4	5	4	4	5	5	5	4	5	4	**4.35**
OSM, Company #25	5	5	4	3	3	3	2	2	5	5	5	5	5	5	4	5	5	**4.18**
CEO, Company #26	2	1	1	1	1	1	1	1	2	4	4	5	4	4	4	5	5	**2.71**
CEO, Company #27	5	5	5	4	5	5	4	4	4	4	4	5	5	5	5	4	4	**4.53**
CEO, Company #28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**4.00**
OSM, Company #29	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	**4.76**
OSM, Company #30	5	5	3	4	4	4	3	4	4	4	4	4	4	5	3	5	5	**4.12**
Mean	**4.27**	**3.80**	**3.37**	**3.07**	**3.90**	**3.53**	**3.40**	**3.13**	**4.23**	**4.23**	**4.20**	**4.63**	**4.23**	**4.53**	**3.57**	**4.50**	**3.97**	**3.92**
Median	**4.5**	**4**	**4**	**3**	**4**	**4**	**4**	**3.5**	**4**	**4**	**4**	**5**	**4**	**5**	**4**	**5**	**5**	**3.88**
Mode	**5**	**5**	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**5**	**4**	**5**	**4**	**5**	**5**	**3.41**
SD	**1.01**	**1.32**	**1.27**	**1.34**	**1.16**	**1.31**	**1.22**	**1.20**	**0.68**	**0.63**	**0.81**	**0.49**	**0.97**	**0.51**	**1.25**	**0.68**	**1.63**	**0.55**

APPENDIX M: STATISTICAL ANALYSIS

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Effectiveness Rating is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.741	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Effectiveness Rating is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.257[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Effectiveness Rating is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.491[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Effectiveness Rating is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Preparedness Rating is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.469	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Preparedness Rating is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.918[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Preparedness Rating is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.439[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Preparedness Rating is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.705[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of B1 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.397	Retain the null hypothesis.
2	The distribution of B2 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.233	Retain the null hypothesis.
3	The distribution of B3 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.981	Retain the null hypothesis.
4	The distribution of B4 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.815	Retain the null hypothesis.
5	The distribution of B5 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.257	Retain the null hypothesis.
6	The distribution of B6 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.157	Retain the null hypothesis.
7	The distribution of B7 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.812	Retain the null hypothesis.
8	The distribution of B8 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.565	Retain the null hypothesis.
9	The distribution of B9 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.946	Retain the null hypothesis.
10	The distribution of B10 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.645	Retain the null hypothesis.
11	The distribution of B11 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.668	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
12	The distribution of B12 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.888	Retain the null hypothesis.
13	The distribution of B13 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.070	Retain the null hypothesis.
14	The distribution of B14 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.156	Retain the null hypothesis.
15	The distribution of B15 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.318	Retain the null hypothesis.
16	The distribution of B16 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.488	Retain the null hypothesis.
17	The distribution of B17 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.202	Retain the null hypothesis.
18	The distribution of B18 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.353	Retain the null hypothesis.
19	The distribution of B19 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.951	Retain the null hypothesis.
20	The distribution of B20 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.206	Retain the null hypothesis.
21	The distribution of C1 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.976	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
22	The distribution of C2 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.309	Retain the null hypothesis.
23	The distribution of C3 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.132	Retain the null hypothesis.
24	The distribution of C4 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.146	Retain the null hypothesis.
25	The distribution of C5 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.274	Retain the null hypothesis.
26	The distribution of C6 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.331	Retain the null hypothesis.
27	The distribution of C7 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.518	Retain the null hypothesis.
28	The distribution of C8 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.032	Reject the null hypothesis.
29	The distribution of C9 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.202	Retain the null hypothesis.
30	The distribution of C10 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.748	Retain the null hypothesis.
31	The distribution of C11 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.100	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
32	The distribution of C12 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.835	Retain the null hypothesis.
33	The distribution of C13 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.777	Retain the null hypothesis.
34	The distribution of C14 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.105	Retain the null hypothesis.
35	The distribution of C15 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.143	Retain the null hypothesis.
36	The distribution of D1 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.136	Retain the null hypothesis.
37	The distribution of D2 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.077	Retain the null hypothesis.
38	The distribution of D3 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.109	Retain the null hypothesis.
39	The distribution of D4 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.956	Retain the null hypothesis.
40	The distribution of D5 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.889	Retain the null hypothesis.
41	The distribution of D6 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.100	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
42	The distribution of D7 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.413	Retain the null hypothesis.
43	The distribution of D8 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.660	Retain the null hypothesis.
44	The distribution of D9 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.454	Retain the null hypothesis.
45	The distribution of D10 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.116	Retain the null hypothesis.
46	The distribution of D11 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.884	Retain the null hypothesis.
47	The distribution of D12 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.492	Retain the null hypothesis.
48	The distribution of D13 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.449	Retain the null hypothesis.
49	The distribution of D14 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.599	Retain the null hypothesis.
50	The distribution of D15 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.689	Retain the null hypothesis.
51	The distribution of D16 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.325	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
52	The distribution of D17 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.176	Retain the null hypothesis.
53	The distribution of E1 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.703	Retain the null hypothesis.
54	The distribution of E2 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.151	Retain the null hypothesis.
55	The distribution of E3 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.567	Retain the null hypothesis.
56	The distribution of E4 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.818	Retain the null hypothesis.
57	The distribution of E5 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.754	Retain the null hypothesis.
58	The distribution of E6 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.779	Retain the null hypothesis.
59	The distribution of E7 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.810	Retain the null hypothesis.
60	The distribution of E8 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.772	Retain the null hypothesis.
61	The distribution of E9 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.683	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
62	The distribution of E10 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.902	Retain the null hypothesis.
63	The distribution of E11 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.103	Retain the null hypothesis.
64	The distribution of E12 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.476	Retain the null hypothesis.
65	The distribution of E13 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.737	Retain the null hypothesis.
66	The distribution of E14 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.711	Retain the null hypothesis.
67	The distribution of E15 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.063	Retain the null hypothesis.
68	The distribution of E16 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.822	Retain the null hypothesis.
69	The distribution of E17 is the same across categories of Company size.	Independent-Samples Kruskal-Wallis Test	.768	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of B1 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.545[1]	Retain the null hypothesis.
2	The distribution of B2 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.391[1]	Retain the null hypothesis.
3	The distribution of B3 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.439[1]	Retain the null hypothesis.
4	The distribution of B4 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
5	The distribution of B5 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.545[1]	Retain the null hypothesis.
6	The distribution of B6 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.819[1]	Retain the null hypothesis.
7	The distribution of B7 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.415[1]	Retain the null hypothesis.
8	The distribution of B8 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.124[1]	Retain the null hypothesis.
9	The distribution of B9 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.632[1]	Retain the null hypothesis.
10	The distribution of B10 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.439[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
11	The distribution of B11 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
12	The distribution of B12 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.917[1]	Retain the null hypothesis.
13	The distribution of B13 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.391[1]	Retain the null hypothesis.
14	The distribution of B14 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.146[1]	Retain the null hypothesis.
15	The distribution of B15 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.305[1]	Retain the null hypothesis.
16	The distribution of B16 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.267[1]	Retain the null hypothesis.
17	The distribution of B17 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.723[1]	Retain the null hypothesis.
18	The distribution of B18 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.415[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
19	The distribution of B19 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.172[1]	Retain the null hypothesis.
20	The distribution of B20 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.787[1]	Retain the null hypothesis.
21	The distribution of C1 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.285[1]	Retain the null hypothesis.
22	The distribution of C2 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.632[1]	Retain the null hypothesis.
23	The distribution of C3 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.200[1]	Retain the null hypothesis.
24	The distribution of C4 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.491[1]	Retain the null hypothesis.
25	The distribution of C5 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.491[1]	Retain the null hypothesis.
26	The distribution of C6 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.391[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
27	The distribution of C7 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.662[1]	Retain the null hypothesis.
28	The distribution of C8 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.002[1]	Reject the null hypothesis.
29	The distribution of C9 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.035[1]	Reject the null hypothesis.
30	The distribution of C10 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.059[1]	Retain the null hypothesis.
31	The distribution of C11 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.215[1]	Retain the null hypothesis.
32	The distribution of C12 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.491[1]	Retain the null hypothesis.
33	The distribution of C13 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.285[1]	Retain the null hypothesis.
34	The distribution of C14 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.305[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
35	The distribution of C15 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.325[1]	Retain the null hypothesis.
36	The distribution of D1 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
37	The distribution of D2 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
38	The distribution of D3 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.267[1]	Retain the null hypothesis.
39	The distribution of D4 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.917[1]	Retain the null hypothesis.
40	The distribution of D5 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.632[1]	Retain the null hypothesis.
41	The distribution of D6 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.573[1]	Retain the null hypothesis.
42	The distribution of D7 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.787[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
43	The distribution of D8 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.545[1]	Retain the null hypothesis.
44	The distribution of D9 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.602[1]	Retain the null hypothesis.
45	The distribution of D10 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.819[1]	Retain the null hypothesis.
46	The distribution of D11 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.851[1]	Retain the null hypothesis.
47	The distribution of D12 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.917[1]	Retain the null hypothesis.
48	The distribution of D13 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.723[1]	Retain the null hypothesis.
49	The distribution of D14 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.950[1]	Retain the null hypothesis.
50	The distribution of D15 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.787[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
51	The distribution of D16 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.917[1]	Retain the null hypothesis.
52	The distribution of D17 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.632[1]	Retain the null hypothesis.
53	The distribution of E1 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.035[1]	Reject the null hypothesis.
54	The distribution of E2 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.015[1]	Reject the null hypothesis.
55	The distribution of E3 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.025[1]	Reject the null hypothesis.
56	The distribution of E4 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.013[1]	Reject the null hypothesis.
57	The distribution of E5 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.391[1]	Retain the null hypothesis.
58	The distribution of E6 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.249[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
59	The distribution of E7 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.146[1]	Retain the null hypothesis.
60	The distribution of E8 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.028[1]	Reject the null hypothesis.
61	The distribution of E9 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.368[1]	Retain the null hypothesis.
62	The distribution of E10 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.232[1]	Retain the null hypothesis.
63	The distribution of E11 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.172[1]	Retain the null hypothesis.
64	The distribution of E12 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.723[1]	Retain the null hypothesis.
65	The distribution of E13 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.325[1]	Retain the null hypothesis.
66	The distribution of E14 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.325[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
67	The distribution of E15 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.039[1]	Reject the null hypothesis.
68	The distribution of E16 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.819[1]	Retain the null hypothesis.
69	The distribution of E17 is the same across categories of Area of operation.	Independent-Samples Mann-Whitney U Test	.851[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of B1 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.093[1]	Retain the null hypothesis.
2	The distribution of B2 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.007[1]	Reject the null hypothesis.
3	The distribution of B3 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.110[1]	Retain the null hypothesis.
4	The distribution of B4 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.058[1]	Retain the null hypothesis.
5	The distribution of B5 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.193[1]	Retain the null hypothesis.
6	The distribution of B6 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.025[1]	Reject the null hypothesis.
7	The distribution of B7 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.918[1]	Retain the null hypothesis.
8	The distribution of B8 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.984[1]	Retain the null hypothesis.
9	The distribution of B9 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.498[1]	Retain the null hypothesis.
10	The distribution of B10 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.473[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
11	The distribution of B11 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.552[1]	Retain the null hypothesis.
12	The distribution of B12 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.886[1]	Retain the null hypothesis.
13	The distribution of B13 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.473[1]	Retain the null hypothesis.
14	The distribution of B14 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.608[1]	Retain the null hypothesis.
15	The distribution of B15 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.697[1]	Retain the null hypothesis.
16	The distribution of B16 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.240[1]	Retain the null hypothesis.
17	The distribution of B17 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.131[1]	Retain the null hypothesis.
18	The distribution of B18 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.580[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
19	The distribution of B19 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.313[1]	Retain the null hypothesis.
20	The distribution of B20 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
21	The distribution of C1 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.313[1]	Retain the null hypothesis.
22	The distribution of C2 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.101[1]	Retain the null hypothesis.
23	The distribution of C3 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.951[1]	Retain the null hypothesis.
24	The distribution of C4 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.525[1]	Retain the null hypothesis.
25	The distribution of C5 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.473[1]	Retain the null hypothesis.
26	The distribution of C6 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.131[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
27	The distribution of C7 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.224[1]	Retain the null hypothesis.
28	The distribution of C8 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.918[1]	Retain the null hypothesis.
29	The distribution of C9 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.257[1]	Retain the null hypothesis.
30	The distribution of C10 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.131[1]	Retain the null hypothesis.
31	The distribution of C11 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
32	The distribution of C12 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.131[1]	Retain the null hypothesis.
33	The distribution of C13 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.224[1]	Retain the null hypothesis.
34	The distribution of C14 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.637[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
35	The distribution of C15 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.240[1]	Retain the null hypothesis.
36	The distribution of D1 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.448[1]	Retain the null hypothesis.
37	The distribution of D2 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.525[1]	Retain the null hypothesis.
38	The distribution of D3 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.525[1]	Retain the null hypothesis.
39	The distribution of D4 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.759[1]	Retain the null hypothesis.
40	The distribution of D5 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.257[1]	Retain the null hypothesis.
41	The distribution of D6 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.154[1]	Retain the null hypothesis.
42	The distribution of D7 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.790[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
43	The distribution of D8 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
44	The distribution of D9 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
45	The distribution of D10 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.984[1]	Retain the null hypothesis.
46	The distribution of D11 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.179[1]	Retain the null hypothesis.
47	The distribution of D12 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.257[1]	Retain the null hypothesis.
48	The distribution of D13 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.822[1]	Retain the null hypothesis.
49	The distribution of D14 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.120[1]	Retain the null hypothesis.
50	The distribution of D15 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.120[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
51	The distribution of D16 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.886[1]	Retain the null hypothesis.
52	The distribution of D17 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.854[1]	Retain the null hypothesis.
53	The distribution of E1 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.697[1]	Retain the null hypothesis.
54	The distribution of E2 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.984[1]	Retain the null hypothesis.
55	The distribution of E3 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.473[1]	Retain the null hypothesis.
56	The distribution of E4 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.275[1]	Retain the null hypothesis.
57	The distribution of E5 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.697[1]	Retain the null hypothesis.
58	The distribution of E6 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.886[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
59	The distribution of E7 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.759[1]	Retain the null hypothesis.
60	The distribution of E8 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
61	The distribution of E9 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.085[1]	Retain the null hypothesis.
62	The distribution of E10 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.208[1]	Retain the null hypothesis.
63	The distribution of E11 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.448[1]	Retain the null hypothesis.
64	The distribution of E12 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.951[1]	Retain the null hypothesis.
65	The distribution of E13 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.448[1]	Retain the null hypothesis.
66	The distribution of E14 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.790[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
67	The distribution of E15 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.667[1]	Retain the null hypothesis.
68	The distribution of E16 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.193[1]	Retain the null hypothesis.
69	The distribution of E17 is the same across categories of Ship Category.	Independent-Samples Mann-Whitney U Test	.984[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of B1 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.743[1]	Retain the null hypothesis.
2	The distribution of B2 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.705[1]	Retain the null hypothesis.
3	The distribution of B3 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.860[1]	Retain the null hypothesis.
4	The distribution of B4 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.321[1]	Retain the null hypothesis.
5	The distribution of B5 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.129[1]	Retain the null hypothesis.
6	The distribution of B6 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.296[1]	Retain the null hypothesis.
7	The distribution of B7 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.
8	The distribution of B8 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.347[1]	Retain the null hypothesis.
9	The distribution of B9 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.494[1]	Retain the null hypothesis.
10	The distribution of B10 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
11	The distribution of B11 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
12	The distribution of B12 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.667[1]	Retain the null hypothesis.
13	The distribution of B13 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.
14	The distribution of B14 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.374[1]	Retain the null hypothesis.
15	The distribution of B15 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.527[1]	Retain the null hypothesis.
16	The distribution of B16 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.033[1]	Reject the null hypothesis.
17	The distribution of B17 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.
18	The distribution of B18 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.595[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
19	The distribution of B19 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.230[1]	Retain the null hypothesis.
20	The distribution of B20 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.050[1]	Retain the null hypothesis.
21	The distribution of C1 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.940[1]	Retain the null hypothesis.
22	The distribution of C2 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.940[1]	Retain the null hypothesis.
23	The distribution of C3 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.038[1]	Reject the null hypothesis.
24	The distribution of C4 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.025[1]	Reject the null hypothesis.
25	The distribution of C5 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.820[1]	Retain the null hypothesis.
26	The distribution of C6 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.321[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
27	The distribution of C7 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.940[1]	Retain the null hypothesis.
28	The distribution of C8 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.044[1]	Reject the null hypothesis.
29	The distribution of C9 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.210[1]	Retain the null hypothesis.
30	The distribution of C10 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.005[1]	Reject the null hypothesis.
31	The distribution of C11 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.667[1]	Retain the null hypothesis.
32	The distribution of C12 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.104[1]	Retain the null hypothesis.
33	The distribution of C13 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.980[1]	Retain the null hypothesis.
34	The distribution of C14 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.860[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
35	The distribution of C15 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.561[1]	Retain the null hypothesis.
36	The distribution of D1 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
37	The distribution of D2 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.595[1]	Retain the null hypothesis.
38	The distribution of D3 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.402[1]	Retain the null hypothesis.
39	The distribution of D4 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.631[1]	Retain the null hypothesis.
40	The distribution of D5 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.374[1]	Retain the null hypothesis.
41	The distribution of D6 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.230[1]	Retain the null hypothesis.
42	The distribution of D7 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.820[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
43	The distribution of D8 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.462[1]	Retain the null hypothesis.
44	The distribution of D9 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.743[1]	Retain the null hypothesis.
45	The distribution of D10 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.296[1]	Retain the null hypothesis.
46	The distribution of D11 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.462[1]	Retain the null hypothesis.
47	The distribution of D12 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.561[1]	Retain the null hypothesis.
48	The distribution of D13 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.
49	The distribution of D14 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	1.000[1]	Retain the null hypothesis.
50	The distribution of D15 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.462[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
51	The distribution of D16 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.296[1]	Retain the null hypothesis.
52	The distribution of D17 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.374[1]	Retain the null hypothesis.
53	The distribution of E1 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.374[1]	Retain the null hypothesis.
54	The distribution of E2 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.494[1]	Retain the null hypothesis.
55	The distribution of E3 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.347[1]	Retain the null hypothesis.
56	The distribution of E4 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.073[1]	Retain the null hypothesis.
57	The distribution of E5 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.494[1]	Retain the null hypothesis.
58	The distribution of E6 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.174[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
59	The distribution of E7 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.038[1]	Reject the null hypothesis.
60	The distribution of E8 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.006[1]	Reject the null hypothesis.
61	The distribution of E9 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.374[1]	Retain the null hypothesis.
62	The distribution of E10 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.082[1]	Retain the null hypothesis.
63	The distribution of E11 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.402[1]	Retain the null hypothesis.
64	The distribution of E12 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.174[1]	Retain the null hypothesis.
65	The distribution of E13 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.940[1]	Retain the null hypothesis.
66	The distribution of E14 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.900[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
67	The distribution of E15 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.210[1]	Retain the null hypothesis.
68	The distribution of E16 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.631[1]	Retain the null hypothesis.
69	The distribution of E17 is the same across categories of Experience of disruption.	Independent-Samples Mann-Whitney U Test	.595[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1]Exact significance is displayed for this test.